MONSANTO
ELECTRONIC
SPECIAL PRODUCTS

DIRECTORY OF GaAsLITE PRODUCTS

Monsanto

INTRODUCTION

The following information describes in detail our complete line of opto-electronic devices.

All of Monsanto's opto-electronic devices have been designed with your needs in mind, and offer you the easiest to use, and available products on the market today. Using this directory, you should be able to meet virtually any requirement you will have for visible and infrared light-emitting diodes, alpha- and numeric-displays, opto-isolators, detectors and CO_2 laser modulator components. If you are unable to find a device in this directory to meet your requirements, please call our plant at Cupertino, California (408) 257-2140 and talk to any of our application engineers. They will do their best to guide you toward an existing product or put you in touch with someone capable to design a product to meet your needs.

In addition to the information contained on the following pages, we have available a series of GaAsLITE Tips with detailed applications information covering all aspects of our product line. If you do not have copies of these booklets, please write to the address below and request a complete set of Monsanto GaAsLITE Tips.

This directory will be issued periodically with new information on Monsanto's growing line of opto-electronic devices. To make sure you get a revised edition when printed, please send your name and address to Monsanto Company, 10131 Bubb Road, Cupertino, California 95014. If there is a reply card attached to this directory, use it. If not, just send a postcard or brief note asking to be placed on Monsanto's ESP mailing list.

Thanks for your interest in our product line and in the field of opto-electronics.

MONSANTO ELECTRONIC SPECIAL PRODUCTS' DIRECTORY OF GaAs LITE PRODUCTS

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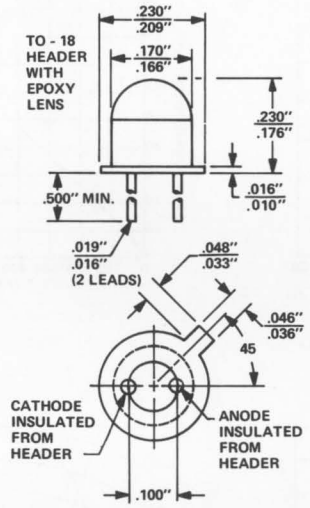
PRODUCT DESCRIPTION

The MV1 is a gallium arsenide phosphide light-emitting diode mounted on a standard TO18 header with epoxy lens.

PACKAGE DIMENSIONS



NOTE: LEAD 2 OMITTED

FEATURES & APPLICATIONS

Monsanto's leadership in compound semi-conductor materials and opto-electronic devices has now been translated into a high brightness (500 ft-L) amber emitting diode. This gallium arsenide phosphide light source when used with the red or green diodes, allows the design engineer flexibility in selecting a specific light source for his equipment.

Some applications include:

- Film annotation
- Card and tape reader light source
- Visual displays
- Character recognition

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C ambient	200 mW
Derate linearly from 25°C	2.67 mW/°C
Storage and operating temperature	-55°C to 100°C
Continuous forward current	70 mA
Reverse voltage	3 volts
Peak forward current (1μsec pulse; 300 pps)	.3 A

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Brightness (see note 1)	200	200		ft-L	I_F=50 mA
Radiated power (see note 2)		10		μW	I_F=50 mA
Peak wavelength	5900	6100	6300	Å	
Spectral line half-width		400		Å	
Forward voltage		2	2.8	V	I_F=50 mA
Capacitance		150		pF	V=0, f=1 MHz
Dynamic resistance		6		Ω	I_F=50 mA
Light rise time and fall time		35		ns	50 Ω system
Reverse current		0.02		μA	V_R=3.0 V

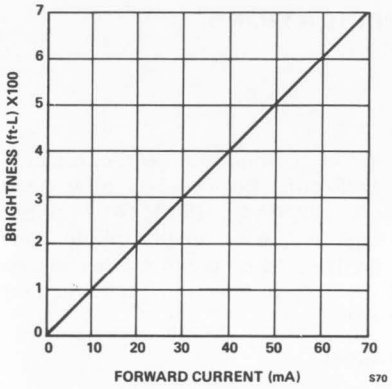
MV1

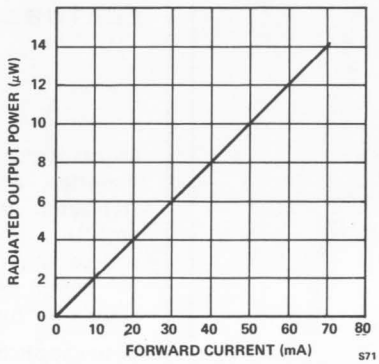
TYPICAL THERMAL CHARACTERISTICS

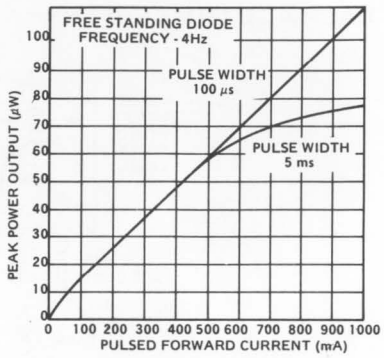
Wavelength temperature coefficient (case temperature) . . . . . 3.0Å/°C
Forward voltage temperature coefficient . . . . . -2.0 mV/°C

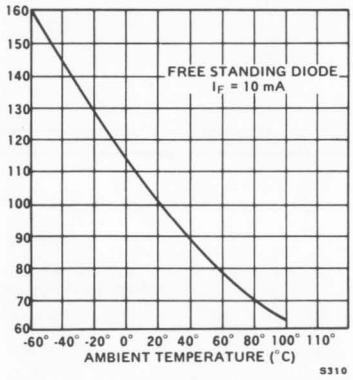
TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

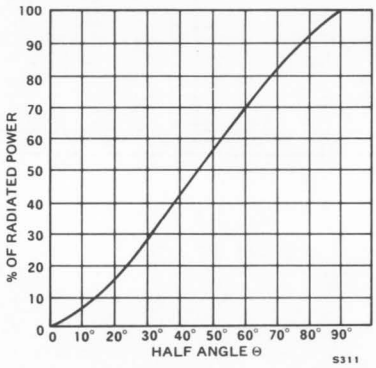
(25°C Free Air Temperature Unless Otherwise Specified)

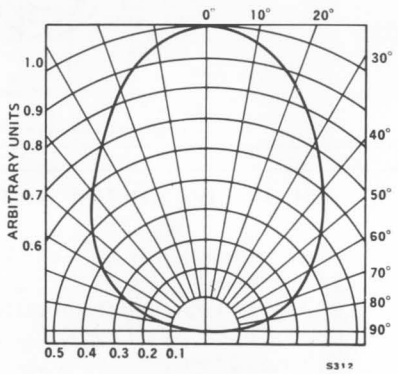












NOTES

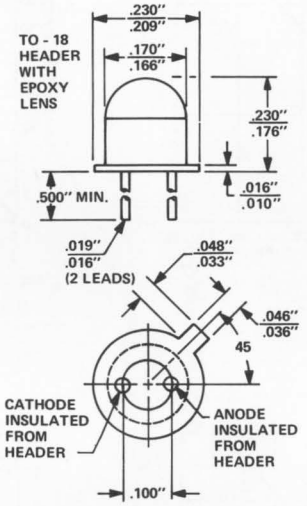
1. *As measured with a Photo Research Spectra Spot Brightness Meter with "SPECTAR" L-175 lens in the brightest region of the emitting surface.*
2. *The total external power output measurements are made with a Centralab 110C solar cell terminated into a 100 ohm impedance.*

Monsanto GREEN LED | MV2

PRODUCT DESCRIPTION

The MV2 is a gallium phosphide green visible light-emitting diode. It is mounted in a TO18 header with epoxy lens.

PACKAGE DIMENSIONS



NOTE: LEAD 2 OMITTED

FEATURES

Monsanto's leadership in compound semi-conductor materials and opto-electronic devices has now been translated into a high brightness (300 ft-L.) green emitting diode. This light source when used with the red or amber diodes, allows the design engineer flexibility in selecting a specific light source for his equipment. Some applications include:

- Film annotation
- Card and tape reader light source
- Visual displays
- Character recognition

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C ambient	200 mW
Derate linearly from 25°C	2.67 mW/°C
Storage and operating temperature	-55°C to 100°C
Continuous forward current	50 mA
Reverse voltage	3 volts
Peak forward current (1 μsec pulse; 300 pps)	.2 A

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Brightness (see note 1)	100	300		ft-L	I_F=50 mA
Radiated power (see note 2)		3		μW	I_F=50 mA
Peak wavelength		5600		Å	
Spectral line half-width		400		Å	
Forward voltage		4	4.5	V	I_F=50 mA
Capacitance		150		pF	V=0, f=1 MHz
Dynamic Resistance		20		Ω	I_F=50 mA
Light rise time and fall time		50		ns	50 Ω system
Reverse current		0.3		μA	V_R=3.0 V

MV2

TYPICAL THERMAL CHARACTERISTICS

Wavelength temperature coefficient (case temperature) . . . . . 3.0Å/°C
Forward voltage temperature coefficient . . . . . -20 mV/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

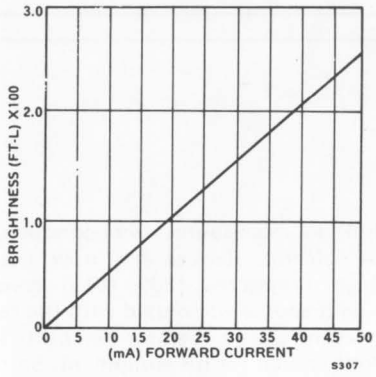


Figure 1

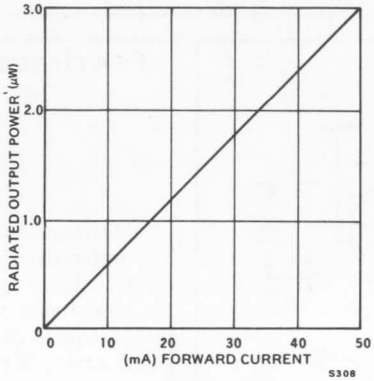


Figure 2

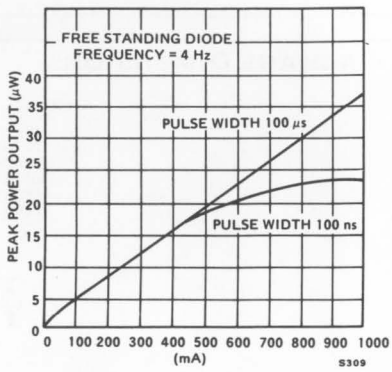


Figure 3

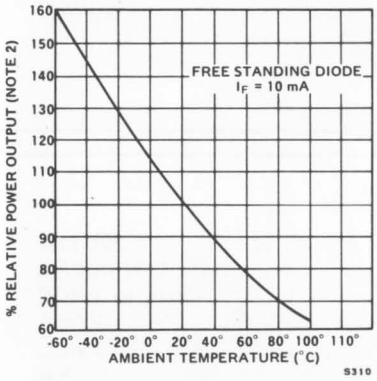


Figure 4

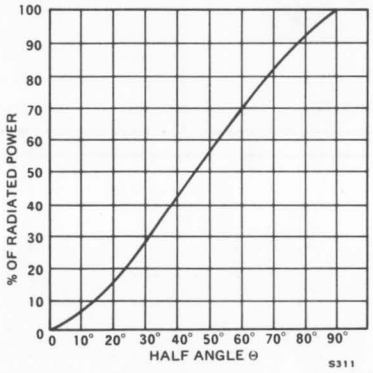


Figure 5

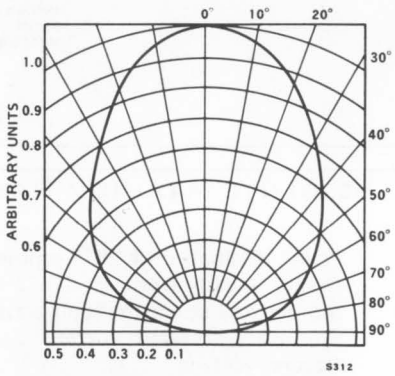


Figure 6

NOTES

1. *As measured with a Photo Research Spectra Spot Brightness Meter with "SPECTAR" L-175 lens in the brightest region of the emitting surface.*
2. *The total external power output measurements are made with a Centralab 110C solar cell terminated into a 100 ohm impedance.*

Monsanto

LOW LENS LED's

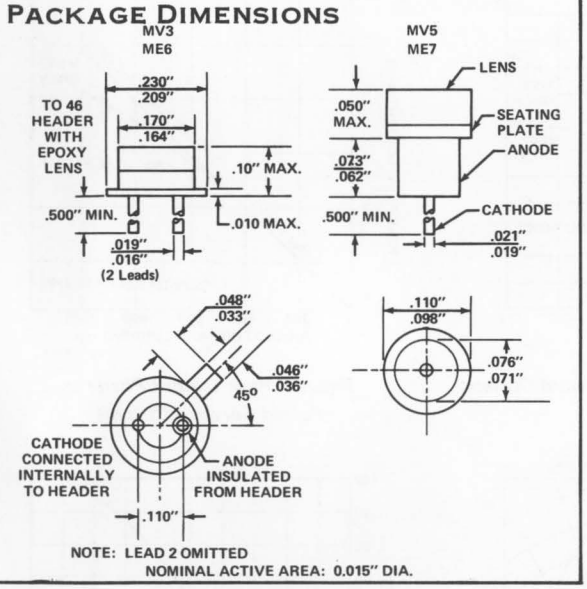
MV3 ME6 MV5 ME7

PRODUCT DESCRIPTION

The MV3 and MV5 are gallium arsenide phosphide, visible light-emitting diodes. The ME6 and ME7 are gallium arsenide infrared light-emitting diodes.

The MV3 and ME6 are mounted on a TO46 header with a flat epoxy lens. The MV5 and ME7 are mounted in a .110-inch coaxial pack with a flat epoxy lens.

PACKAGE DIMENSIONS



NOTE: LEAD 2 OMITTED
NOMINAL ACTIVE AREA: 0.015" DIA.

FEATURES & APPLICATIONS

- The low lens allows easy interfaceability with external optics and fiber optics and the LEDs.
- The low lens also allows contact annotation of film.
- The narrow spectral bandwidth offers a monochromatic light source for controlled detector/film sensitivity matching.
- The nanosecond switching of the LEDs allows an extremely fast rate of annotation. They are LIGHT QUICK.
- Low driving power is required. The LEDs are compatible with ICs.
- They are solid state rugged and reliable. The life is 1,000,000 hrs.
- Their small size offers space savings.

♦

- The low lens, red visible and infrared, light emitting diodes are designed specifically for:

Film annotation	Card and tape reader light source.
Character recognition	Calibrating high-speed detectors.
Visual displays	Electrical isolation
Optical encoders	(when coupled to detectors.)

ABSOLUTE MAXIMUM RATINGS

	ME7 - MV5	ME6 - MV3
Power Dissipation @ 25°C Ambient Temperature	130 mW	250 mW
Derate linearly from 25°C	1.73 mW/°C	3.33 mW/°C
Storage and Operating Temperature	-55°C to 100°C	-55°C to 100°C
Lead Solder Time @ 260°C (See Note 1)	7.0 sec	7.0 sec
Continuous Forward Current	70 mA	120 mA
Peak Forward Current (1μsec pulse, 300 pps)	0.5 A	3.0 A
Reverse Voltage	3.0 V	3.0 V

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

	VISIBLE RED MV3-MV5			INFRARED ME6-ME7				
CHARACTERISTICS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Total external radiated power (see note 2)	30	50		300	500		μW	I_F=50 mA
Brightness (see note 3)		150					ft-L	I_F=50 mA
Peak emission wave length	6700	6850	7000		9000		Å	
Spectral line half width		400			400		Å	
Forward voltage		1.65	2.0		1.3	1.5	V	I_F=50 mA
Forward dynamic resistance		2.0			1.2		Ω	I_F=50 mA
Capacitance		150			150		pF	V=0
Light turn on and turn off		1.0			1.0		μs	
Reverse current			100			100	μA	V_R=3.0 V

MV3 MV5 ME6 ME7

TYPICAL THERMAL CHARACTERISTICS

	TYPE	VALUE
Thermal Resistance Junction to Free Air (Θ_{JA})	MV5, ME7	350°C/W
	MV5, ME6	300°C/W
Thermal Resistance Junction to Case (Θ_{JC})	MV5, ME7	170°C/W
	MV3, ME6	90°C/W
Wavelength Temperature Coefficient (Case Temperature)	MV3, MV5	3.0 Å/°C
	ME6, ME7	2.8 Å/°C
Forward Voltage Temperature Coefficient	MV3, MV5	-2.0 mV/°C
	ME6, ME7	-1.8 mV/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

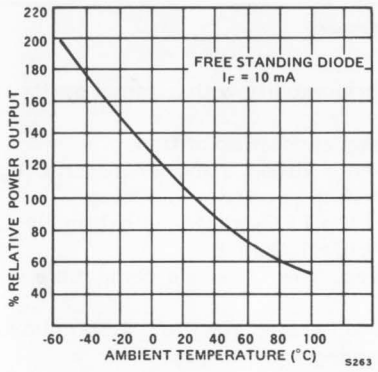


Figure 1 Power Output vs. Temperature

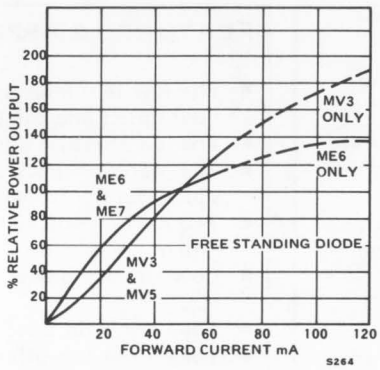


Figure 2 Power Output vs. Forward Current

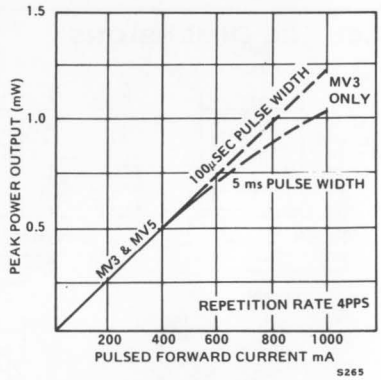


Figure 3 Peak Output Power vs. Pulsed Forward Current

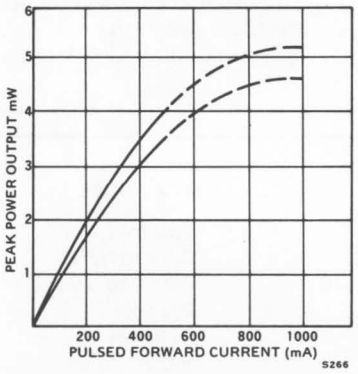


Figure 4 Peak Output Power vs. Pulsed Forward Current

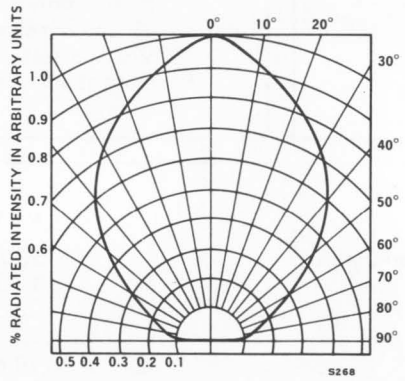


Figure 5 Spacial Distribution

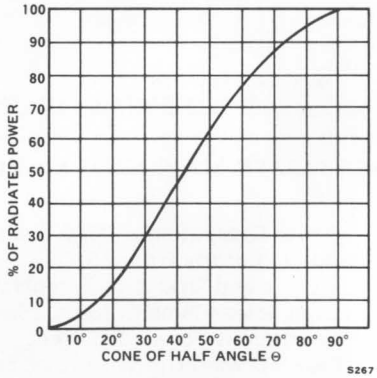


Figure 6 Percent of Radiated Power into Cone of Half Angle Θ

NOTES

1. *The leads of the MV3 and ME6 were immersed in molten solder, heated to 260°C, at a point 1/16 inch from the body of the device.*
   Suggested mounting procedures for MV5 and ME7 are:
   (a) When soldering use wet sponge to heat sink lens.
   (b) Use conductive epoxy.
   (c) Press fit
2. *The total external power output measurements are made with a Centralab 110C solar cell terminated into a 100 ohm impedance.*
3. *As measured with a Photo Research Spectra Spot Brightness Meter with "SPECTAR" L-175 lens in the brightest region of the emitting surface.*

HIGH POWER VISIBLE LED's

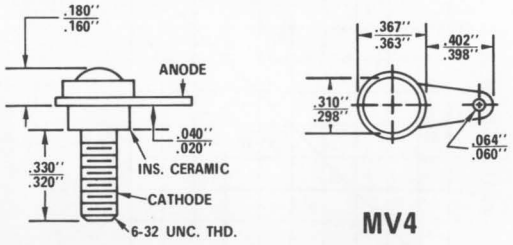
MV4 MV4H

PRODUCT DESCRIPTION

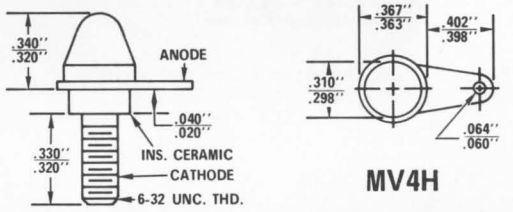
The MV4 is a high-brightness, diffused planar gallium arsenide phosphide diode mounted on a standard TO5 stud header with an epoxy dispursive lens.

The MV4H is the same as the MV4 except for a high-collimating epoxy lens.

PACKAGE DIMENSIONS



MV4



MV4H

FEATURES

- Illuminator for dark adapted area
- Bright red light
- Large emitting area
- 5000 ft-L @ I_F = 1.0A
- Choice of lambertian or collimated light
- Long life -- solid state reliability

◆

The MV4 and MV4H are large area GaAsLites recommended especially for such military and industrial applications as reading illuminators in dark adapted areas and lighting in photographic dark rooms. They are also ideal as indicator lights where visibility at greater than average distances is required.

Recommended "BIG RED" applications include:

- Night Vision Illuminators
- High Intensity Indicators
- Alarm Signals
- Electrical Isolators
- Warning Flashers

ABSOLUTE MAXIMUM RATINGS

Power Dissipation @25°C Case Temperature	2 watts
Derate Linearly From 25°C	26.7 mW/°C
Storage and Operating Temp.	-55°C to 100°C
Continuous Forward Current (Note 2)	1 A
Peak Forward Current (Note 2) (1μs Pulse width 300 pps)	25 A
Reverse Voltage	3 volts

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Case Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Total external radiated power					
MV4 (see note 1)	.75	1		mW	I_F=.5 A
MV4H (see note 1)		2		mW	I_F=1.0 A, λ=6700 Å
Brightness					
MV4		2500		ft-L	I_F=.5 A
MV4H		5000		ft-L	I_F=1.0 A
Peak Emission Wavelength	6500	6700	7000	Å	
Spectral Line Half Width		400		Å	
Forward Voltage		1.7	2.0	V	I_F=.5 A
Capacitance		750		pF	V=0
Light Rise Time or Fall Time		10		ns	
Reverse Voltage	3.0			V	I_R=100 μA

MV4 MV4H

THERMAL CHARACTERISTICS

Wavelength Temperature Coefficient (Case Temperature) . . . . . 2.8 Å/°C

Forward Voltage Temperture Coefficient . . . . . 1.8 mV/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

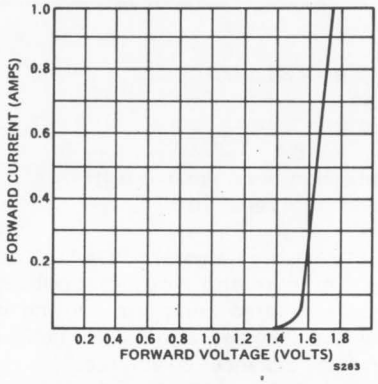


Figure 1 Forward Current vs. Forward Voltage

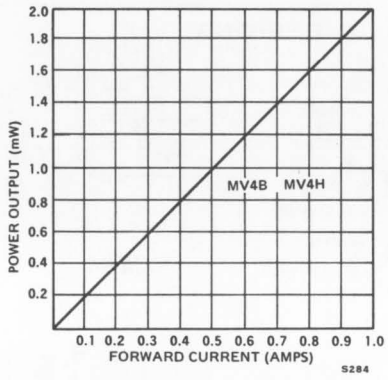


Figure 2 Power Output vs. Forward Current

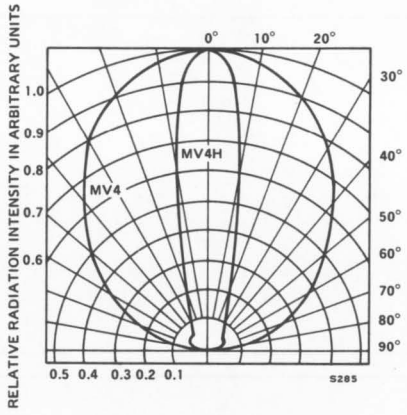


Figure 3 Spacial Distribution

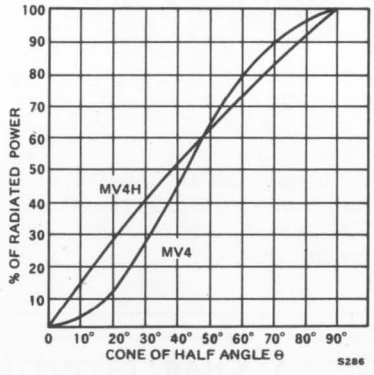


Figure 4 Percent of Radiated Power into Cone of Half Angle Θ

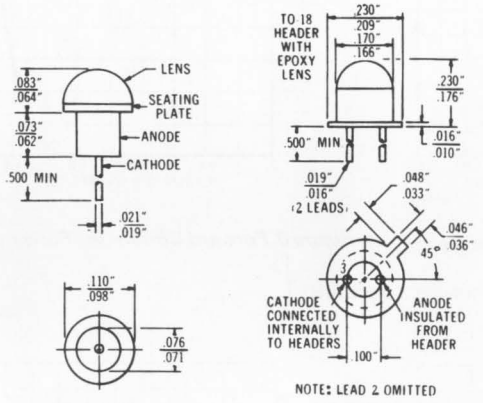
NOTES

1. *The total external radiated power output measurements are made a centralab 2A solar cell terminated into a 10Ω impedance.*
2. *Units must be sufficiently heat sunk above 150mA input current.*

PRODUCT DESCRIPTION

The MV10A and MV10B series of visible light emitting diodes are made of Diffused GaAsP. The A series is mounted on .110" coaxial headers with a protective epoxy lens. The B series is mounted in a TO18 header with a protective epoxy lens.

PACKAGE DIMENSIONS



MV10A
MV10A3

MV10B
MV10B3

See note 3

FEATURES

- High Efficiency--5mA max. to produce 50 ft-L.
- Ultra High Brightness--Typ. 1000 ft-L @50mA.
- Long Life--Solid State Reliability.
- Low Power Requirements--Typ. 10mW for 50 ft-L.
- Compatible with Integrated Circuits--DTL, RTL, T^2L.
- Compact, Rugged, Lightweight.

ABSOLUTE MAXIMUM RATINGS

	MV10A-MV10A3	MV10B-MV10B3
Maximum Power Dissipation @25°C Ambient Temperature	150mW	175mW
Derate Linearly from 25°C	2.0mW/°C	2.33mW/°C
Maximum Storage & Operating Temperature	-55°C to +100°C	-55°C to +100°C
Maximum Lead Solder Time @260°C (see note 4)	7.0 s	7.0 s
Maximum Currents and Voltages Continuous Forward Current	70mA	70mA
Peak Forward Current (1μsec. pulse, 300 pps)	3.0A	3.0A
Reverse Voltage	3.0V	3.0V

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

	MV10A MV10B			MV10A3 MV10B3				
CHARACTERISTICS	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (see note 1)		500			1000		ft-L	I_F=50mA
Current to produce 50 ft-L (see note 1)			10			5.0	mA	
Total external radiated power (see note 2)		50			100		μA	I_F=50 mA, λ=6750 Å
Peak emission wave length	6300		7000	6300		7000	Å	
Spectral line half width		400			400		Å	
Forward voltage		1.65	2.0		1.65	2.0	V	I_F=50 mA
Forward dynamic resistance		2.0			2.0		Ω	I_F=50 mA
Capacitance		135			135		pF	V=0
Light turn on and turn off		1.0			1.0		ns	
Reverse current		0.3			0.3		μA	V_R=3.0 V

MV10A MV10B MV10A3 MV10B3

TYPICAL THERMAL CHARACTERISTICS

	MV10A-MV10A3	MV10B-MV10B3
Thermal Resistance Junction to Free Air (Θ_{JA})	350° C/W	320° C/W
Thermal Resistance Junction to Case (Θ_{JC})	170° C/W	155° C/W
Wavelength Temperature Coefficient (case temperature)	3.0 Å/°C	3.0 Å/°C
Forward Voltage Temperature Coefficient	-2.0 mV/°C	-2.0 mW/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS CURVES

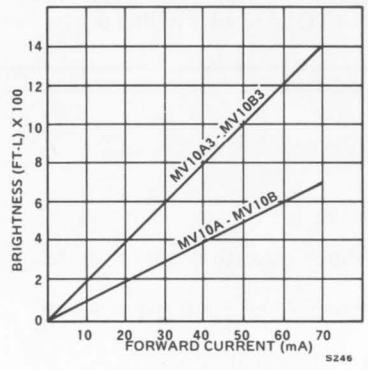


Figure 1 Brightness vs. Forward Current

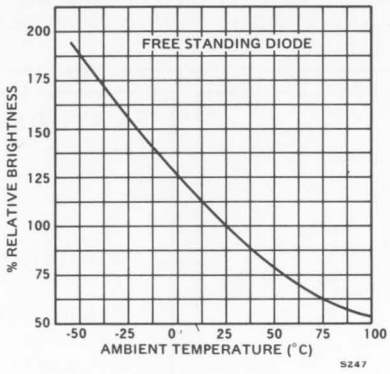


Figure 2 Brightness vs. Temperature

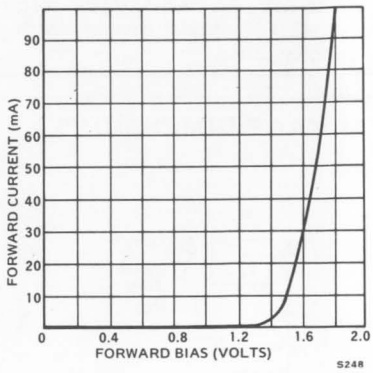


Figure 3 Forward Current vs. Forward Voltage

(25°C Free Air Temperature Unless Otherwise Specified)

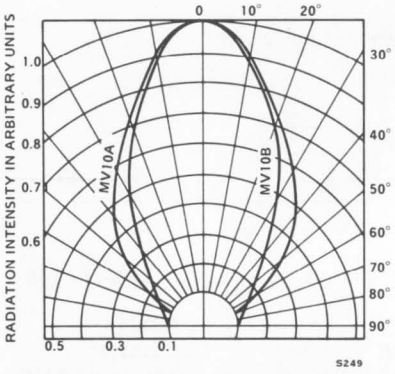


Figure 4 Spacial Distribution

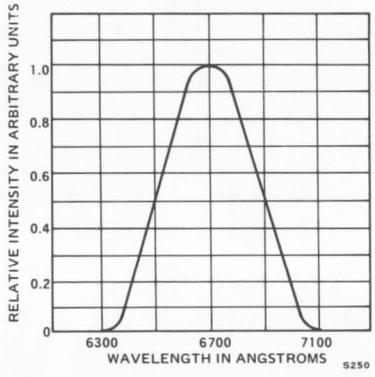


Figure 5 Spectral Distribution

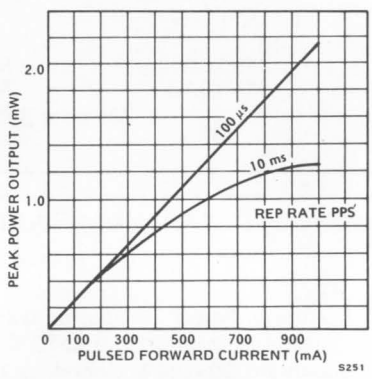


Figure 6 Peak Power Output vs. Pulsed Forward Current

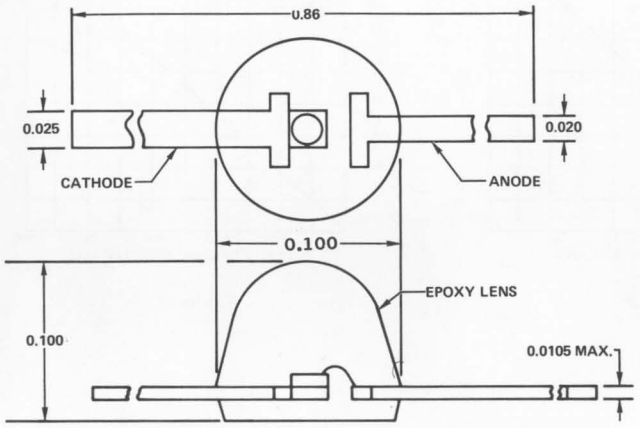
NOTES

1. *As measured with a Photo Research Spectra Spot Brightness Meter with "Spectar" L-175 lens in the brightest region of the emitting surface.*
2. *The total external power output measurements are made with a Centralab 100C solar cell terminated into a 100 ohm impedance.*
3. *The apparent spot size diameter for the MV10A, MV10A3, and MV10B, MV10B3 are 0.025-inch minimum to 0.048-inch maximum and 0.025-inch minimum to 0.066-inch maximum respectively.*
4. *The leads of the MV10B and MV10B3 were immersed in molten solder, heated to 260°C, to a point 1/16-inch from the body of the device per MIL-S-750. Suggested mounting procedures for MV10A and MV10A3: (a) Use wet sponge to heat sink lens when soldering (b) Use conductive epoxy (c) Press fit.*

PRODUCT DESCRIPTION

The MV50 is a diffused Gallium Arsenide Phosphide diode mounted in a two lead epoxy package.

PACKAGE DIMENSIONS



ALL DIMENSIONS ARE NOMINAL IN INCHES

FEATURES

The MV50 is intended for high volume indicator light applications where low cost, high reliability, and top performance are required. Major usage is expected in applications such as diagnostic lights on printed circuit boards and panel lights. The MV50 can be used to displace subminiature lamps as small as T3/4 size.

- Low cost
- Bright
- Compatible with integrated circuits
- Long life, rugged
- Small size - T3/4
- Easily assembled in arrays

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C ambient	80 mW
Derate linearly from 50°C	1.6 mW/°C
Storage temperature	-55°C to 100°C
Operating temperature	100°C
Lead solder time @ 260°C (note 1)	3.0 s
Continuous forward current	40 mA
Reverse voltage	3.0 volts

ELECTRO-OPTICAL CHARACTERISTICS

	MINIMUM	TYPICAL	MAXIMUM	UNITS	TEST CONDITIONS
Brightness (note 2)		750		ft.-L	I_F=20 mA
Current to produce 50 ft-L		1.0	10	mA	
Total external radiated power		38		μW	I_F=20 mA
Peak emission wavelength	6300	6500		Å	I_F=20 mA
Spectral line halfwidth		400		Å	I_F=20 mA
Forward voltage		1.65	2.0	V	I_F=20 mA
Capacitance		80		pF	V=0
Light turn on & turn off		1.0		ns	
Reverse current		5.0		nA	V_R=3.0 V

MV50

TYPICAL THERMAL CHARACTERISTICS

Wavelength temperature coefficient (case temperature) . . . . . .30Å/°C
Forward voltage temperature coefficient . . . . . .-2.0 mV/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

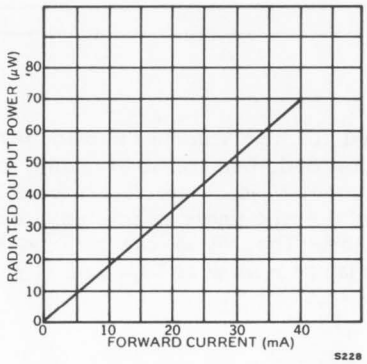


Figure 1

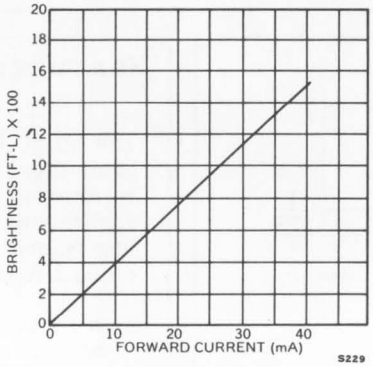


Figure 2

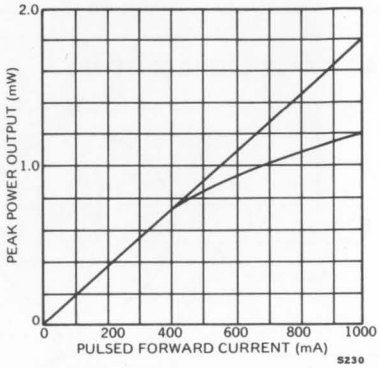


Figure 3

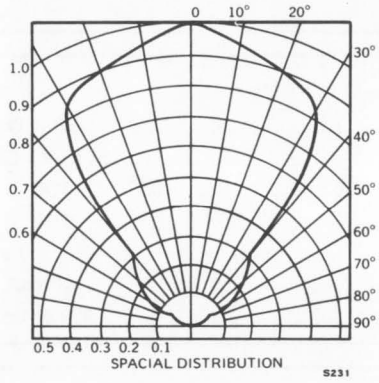


Figure 4

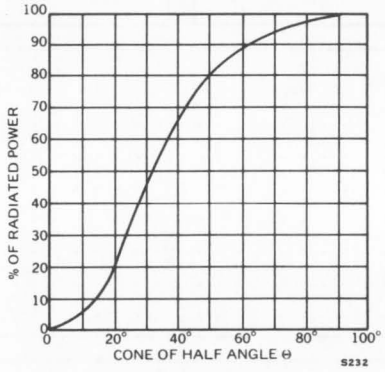


Figure 5

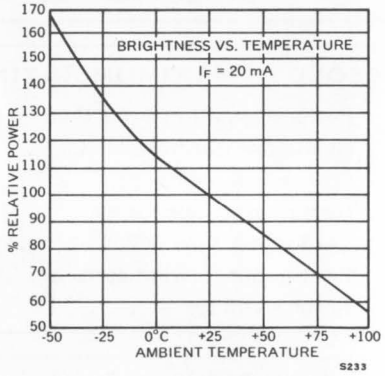


Figure 6

NOTES

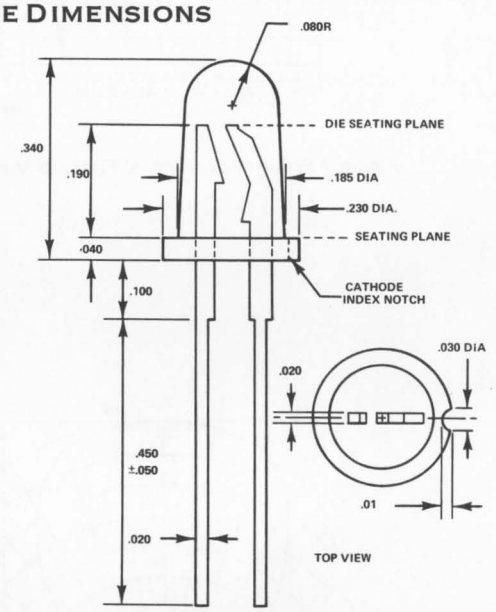
1. *The leads of the device were immersed in molten solder at 260° C to a point 1/16 inch from the body of the device per MIL-S-750.*
2. *As measured with a photo Research Spectra Spot Brightness Meter with "Spectar" L-175 lens in the brightest region of the emitting surface.*

Monsanto RED SOLID STATE LAMP | MV5020 SERIES

PRODUCT DESCRIPTION

The MV5020 series are gallium arsenide phosphide light-emitting diodes mounted in epoxy snap-in packages for both .062- and .125-inch panels. A black snap-in clip is provided with each solid-state lamp.

PACKAGE DIMENSIONS



TOLERANCES ±.005

FEATURES

The MV5020 series solid state lamps are designed as panel indicator lights. They are intended for mounting in standard 0.062-inch to 0.125-inch panels using a plastic snap-in dip. The MV5020 provides a high intensity, wide angle light for good visibility under all normal ambient conditions.

A number of lens options are available as standards.

- MV5020 clear
- MV5021 diffused
- MV5022 red-clear
- MV5023 red-diffused

A black, snap-in clip is provided with each solid state lamp for small quantity orders. For orders over 1,000 units, the clip should be specified separately.

ABSOLUTE MAXIMUM RATINGS

Maximum power dissipation @ 25°C ambient	140 mW
Thermal resistance junction to free air (Q_{JA})	250°C/W
Maximum storage & operating temperature	-55°C to 100°C
Maximum lead solder time @ 260°C (see note 2)	5 sec
Maximum currents and voltages	
Continuous forward current	70 mA
Peak forward current (1μsec pulse width; 300 pps)	.2 A
Reverse voltage	3.0 V

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITION
Brightness MV5020 (see note 1)	100	750		ft-L	I_F=20 mA
Current to produce 50 ft-L (see note 1)		2	10	mA	
Luminous Flux		1.4		mLumen	I_F=20 mA
Peak wave length	6300	6500	7000	Å	I_F=20 mA
Spectral line half width		400		Å	I_F=20 mA
Forward voltage		1.6	2.0	V	I_F=20 mA
Reverse current			100	μA	V_R=3.0 V
Capacitance		80		pF	V=0
Light rise and fall time		50		ns	50 Ω system

MV5020

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

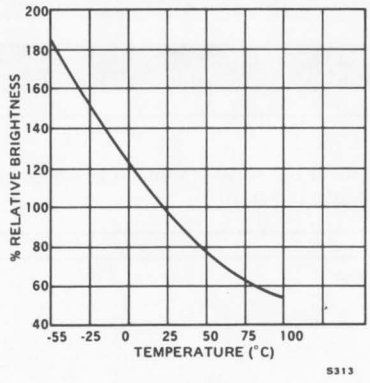


Figure 1 Relative Brightness vs. Ambient Temperature

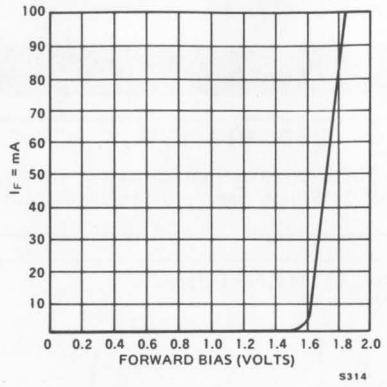


Figure 2 Forward Current vs. Forward Voltage

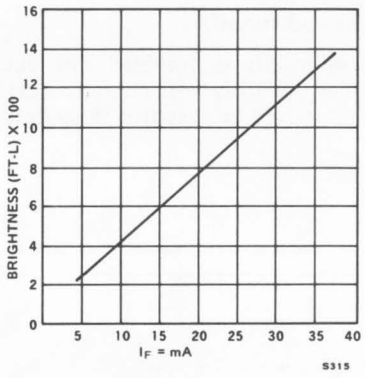


Figure 3 Brightness vs. Forward Current

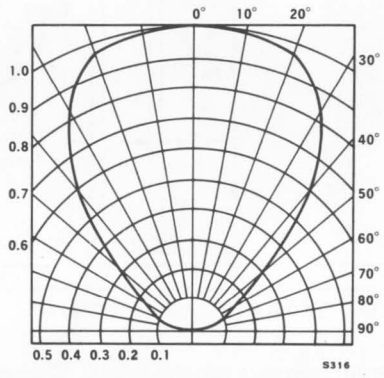


Figure 4 Spacial Distribution

NOTES

1. *As measured with a Photo Research Spectra Brightness Spot Meter with "SPECTAR" L-175 lens in the brightness region of the emitted surface.*
2. *The leads of the device were immersed in molten solder at 280°C to a point 1/16-inch from the body of the device per MIL-S-750.*

Monsanto

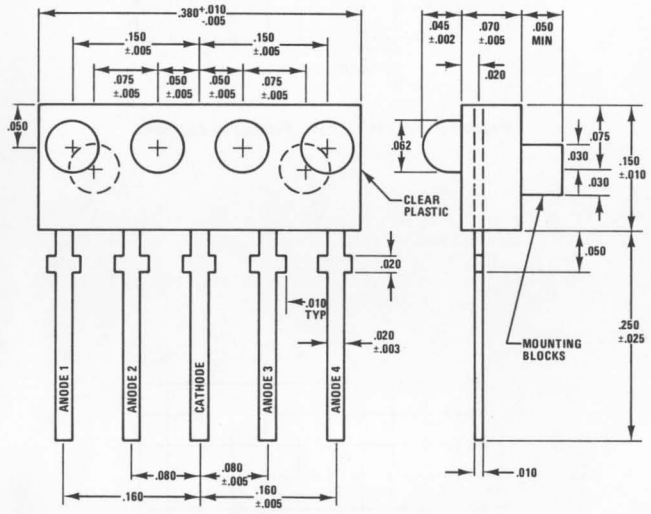
VISIBLE LED ARRAY

MV5040

PRODUCT DESCRIPTION

The MV5040 consists of four gallium arsenide phosphide diodes mounted in a single, five-lead epoxy package.

PACKAGE DIMENSIONS



FEATURES

The MV5040 is intended for high volume indicator light applications where multiple indicators are required. Major usage is expected in applications such as diagnostic lights on printed circuit boards and panel lights. The MV5040 is ideal for edge card lighting on PC boards.

- Low cost
- Bright - 750 ft-L
- Compatible with integrated circuits
- Long life, rugged
- Small size
- Easily assembled in arrays. Stack end-to-end on 0.100 inch center line between diodes.

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C ambient	70mW
Derate linearly from 25°C	1.6mW/°C
Storage temperature	-55°C to 100°C
Operating temperature	70°C
Lead solder time @ 260°C (Note 1)	3.0sec
Continuous forward current	40 mA
Reverse voltage	3.0 volts

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (notes 2 & 3)		1000		ft-L	I_F=20 mA
Current to produce 50 ft-L		2	10	mA	
Peak emission wavelength	6300	6500		Å	I_F=20 mA
Spectral line halfwidth		400		Å	I_F=20 mA
Forward voltage		1.60	2.0	V	I_F=20 mA
Capacitance		100		pF	V=0
Light turn on and turn off		25		ns	50 Ω system
Reverse current		0.3		μA	V_R=3.0 V

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

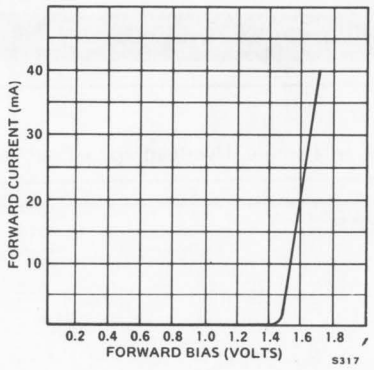


Figure 1 Forward Current vs. Forward Voltage

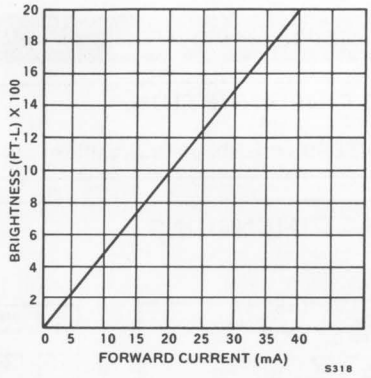


Figure 2 Brightness vs. Forward Current

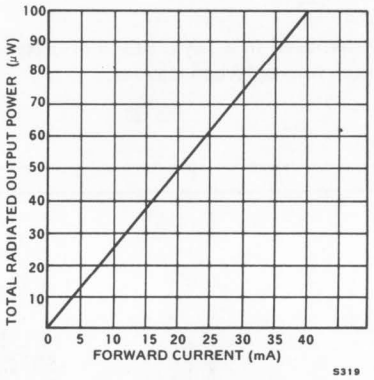


Figure 3 Radiated Output Power vs. Forward Current

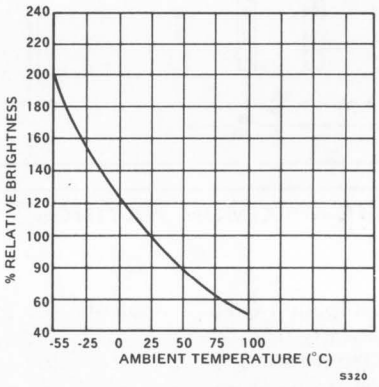


Figure 4 Relative Brightness vs. Ambient Temperature

NOTES

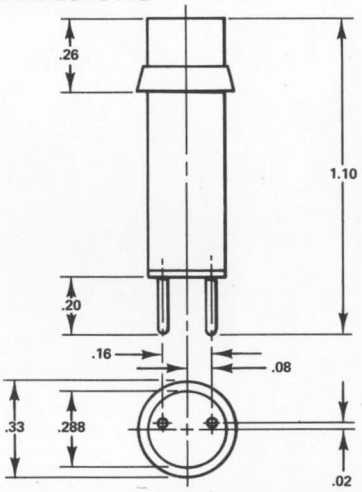
1. *The leads of the device were immersed in molten solder, at 260°C, to a point 1/16 inch from the body of the device per MIL-S-750.*
2. *As measured with a Photo Research Spectra Spot Brightness Meter with "SPECTAR" L-175 lens in the brightness region of the emitting surface.*
3. *Brightness match between diodes kept within ±25% of each array.*

Monsanto CARTRIDGE INDICATORS | MV9000 SERIES

PRODUCT DESCRIPTION

The MV9000 series cartridge lamps are red, amber, or green light-emitting diodes mounted in a black anodized aluminum case with stainless steel pins. They are protected by a clear transparent lens. These cartridges fit into a standard cartridge holder.

PACKAGE DIMENSIONS



FEATURES

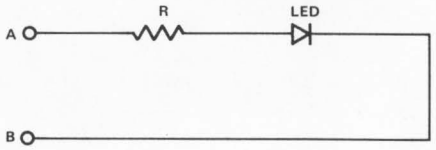
The Monsanto cartridge lamps use a high brightness LED as the lamp. The LED offers long life (10^6 hours) and solid-state reliability with low power requirements. These can be used to replace present cartridges that use incandescent lamps.

These cartridge lamps are available in red, amber, and green with a clear (transparent) lens.

The MV 9000 series cartridge lamps are manufactured under conditions conforming to MIL-L-3661.

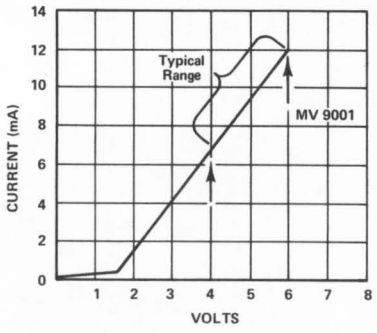
Long Life - 10^6 + hr	Direct Replacement in Sockets
Low Power	Never Replace Replacement
High Brightness	3 Lamps Fit Any Voltage Up to
Cool Operation	30V (Starting at 4.0V)

SPECIFICATIONS



PART NUMBER	VOLTAGE (VOLTS)	CURRENT (MA)	COLOR	RESISTOR (OHMS)
MV9001	4 - 6	10	Red	330
MV9002	7 - 14	10	Red	1000
MV9003	15 - 30	10	Red	2700
MV9004	4 - 6	20	Amber	180
MV9005	7 - 14	20	Amber	470
MV9006	15 - 30	20	Amber	1000
MV9007	4 - 6	50	Green	56
MV9008	7 - 14	50	Green	220
MV9009	15 - 30	40	Green	680

Rated life for red and amber is 10^6 hours for typical operating conditions. Correlating life data on the green diode is being accumulated.



NOTES

1. *Other voltage and current ratings (both AC and DC) and lens configurations are available on special order.*
2. *Voltages available: 1.7 through 30*
3. *Currents available: 10 mA through 70 mA*
4. *Up to 50% over voltage without seriously affecting life.*

Monsanto

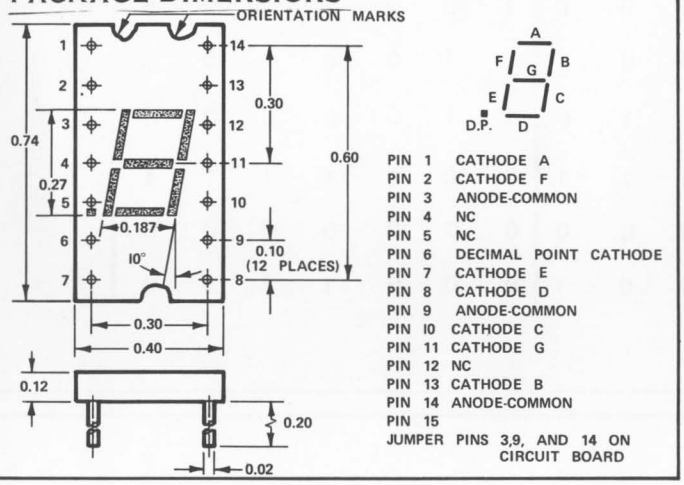
ALPHA-NUMERIC DISPLAY

MANI

PRODUCT DESCRIPTION

The MAN1 is a seven segment diffused planar GaAsP light emitting diode array. It is mounted on a dual in-line 14 pin substrate and then encapsulated in clear epoxy for protection. It is capable of displaying all digits and nine distinct letters.

PACKAGE DIMENSIONS



PIN 1 CATHODE A
PIN 2 CATHODE F
PIN 3 ANODE-COMMON
PIN 4 NC
PIN 5 NC
PIN 6 DECIMAL POINT CATHODE
PIN 7 CATHODE E
PIN 8 CATHODE D
PIN 9 ANODE-COMMON
PIN 10 CATHODE C
PIN 11 CATHODE G
PIN 12 NC
PIN 13 CATHODE B
PIN 14 ANODE-COMMON
PIN 15
JUMPER PINS 3,9, AND 14 ON CIRCUIT BOARD

FEATURES

- High brightness . . . Typically 350 ft-L @ 20 mA
- Single plane, wide angle viewing . . . 150°
- Unobstructed emitting surface
- Standard 14 pin dual-in-line package configuration
- Long operating life . . . solid state reliability
- Shock resistant
- Operates with IC voltage requirements
- Small size; offering unique styling advantages
- All numbers plus 9 distinct letters
- Usable for wide viewing angle requirements
- Usable in vibrating environment, impervious to vibration

◆

The MAN 1 is for industrial and military applications such as:

- Digital readout displays
- Cockpit readout displays
- Directly compatible with integrated circuits

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C ambient	750 mW
Derate linearly from 25°C	10 mW/°C
Storage and operating temp	-55°C to 100°C
Continuous forward current	
Total	240 mA
Per segment	30 mA
Decimal point	30 mA
Reverse Voltage	
Per segment	6.0 volts
Decimal point	3.0 volts

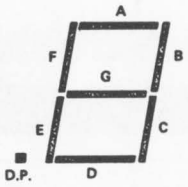
ELECTRO-OPTICAL CHARACTERISTICS

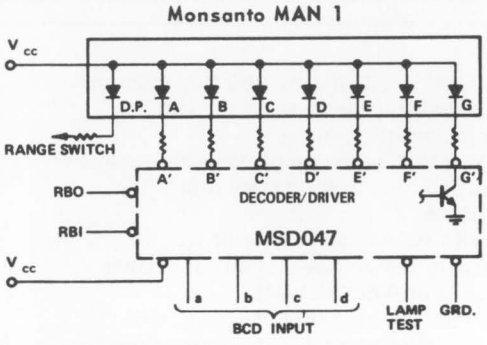
(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1)					
Segment	100	350		ft-L	I_F=20 mA, λ=6500 Å
Decimal point	100	350		ft-L	I_F=20 mA, λ=6500 Å
Peak emission wave length	6300		7000	Å	
Spectral line half width		400		Å	
Forward voltage					
Segment		3.4	4.0	V	I_F=20 mA
Decimal point		1.6	2.0	V	I_F=20 mA
Dynamic resistance					
Segment		11		Ω	I_F=20 mA
Decimal point		5.5		Ω	I_F=20 mA
Capacitance					
Segment		80		pF	V=0
Decimal point		135		pF	V=0
Reverse Current					
Segment			100	μA	V_R=6.0 volts
Decimal point			100	μA	V_R=3.0 volts

MANI

DECODER/DRIVER FUNCTIONAL DIAGRAM





TYPICAL TRUTH TABLE

INPUT CODE				OUTPUT STATE							DISPLAY
d	c	b	a	A′	B′	C′	D′	E′	F′	G′	
0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	1	0	0	1	1	1	1	1
0	0	1	0	0	0	1	0	0	1	0	2
0	0	1	1	0	0	0	0	1	1	0	3
0	1	0	0	1	0	0	1	1	0	0	4
0	1	0	1	0	1	0	0	1	0	0	5
0	1	1	0	1	1	0	0	0	0	0	6
0	1	1	1	0	0	0	1	1	1	1	7
1	0	0	0	0	0	0	0	0	0	0	8
1	0	0	1	0	0	0	1	1	0	0	9

TYPICAL CURVES

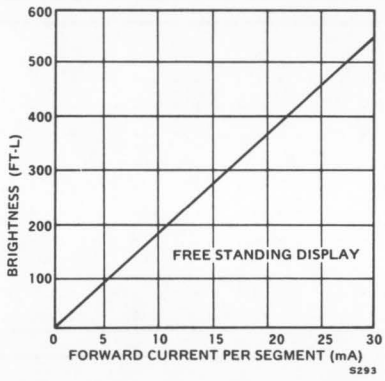


Figure 1 Brightness vs. Forward Current

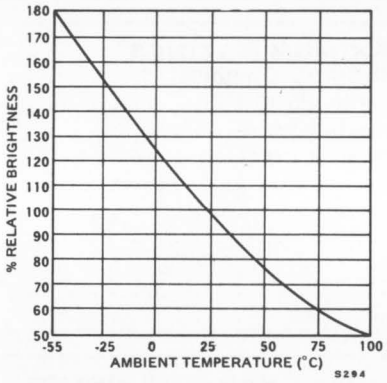


Figure 2 Brightness vs. Temperature

TYPICAL THERMAL CHARACTERISTICS

Thermal Resistance (note 4) Junction to free air Θ_{JA} . . . . . .440°C/W
Wavelength Temperature Coefficient (case temp) . . . . . .3.0 Å/°C
Forward Voltage Temperature Coefficient . . . . . .-3.0 mV/°C

NOTES

1. *As measured with a Photo Research Spectra Microcandela Meter corrected for wavelength error. Brightness cannot vary more than ±50% between all segments.*
2. *The curve in Figure 2 is normalized to the brightness at 25°C to indicate the relative efficiency over the operating temperature range.*
3. *For contrast improvement Polaroid HRCP7 circular polarizer filter can be used. Non-glare circular polarizer filter will provide further enhancement in display visibility.*
4. *Thermal resistance (junction to ambient) value of any one segment with all segments in operation.*

Monsanto

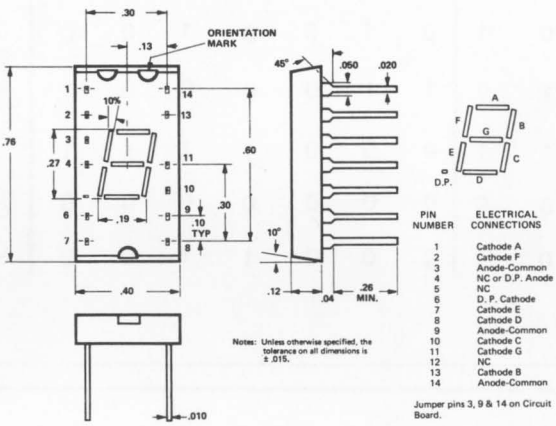
ALPHA-NUMERIC DISPLAY

MANIA MANIB

PRODUCT DESCRIPTION

The MAN1A/B is a seven segment diffused planar gallium arsenide phosphide light emitting diode array. It is mounted on a dual in-line 14 pin substrate and then encapsulated in red epoxy for protection. It is capable of displaying 10 digits and 9 distinct letters.

PACKAGE DIMENSIONS



PIN NUMBER	ELECTRICAL CONNECTIONS
1	Cathode A
2	Cathode F
3	Anode-Common
4	NC or D.P. Anode
5	NC
6	D. P. Cathode
7	Cathode E
8	Cathode D
9	Anode-Common
10	Cathode C
11	Cathode G
12	NC
13	Cathode B
14	Anode-Common

Notes: Unless otherwise specified, the tolerance on all dimensions is ± .015.

Jumper pins 3, 9 & 14 on Circuit Board.

ALL DIMENSIONS NOMINAL IN INCHES

FEATURES

- 0.270 inch high LED 7-segment display
- High brightness - 350ft-L at 20mA
- Wide viewing angle, single plane display
- Red lens for improved contrast ratio
- Standard 14 pin DIP
- Solid state reliability for long operating life
- Shock
- Compatible with standard digital IC's
- Pulse tested for multiplexing applications
- Common (1A) or separate (1B) anode decimal point versions

- Digital readout displays
- Cockpit readout displays
- Directly compatible with integrated circuits
- All numbers plus 9 distinct letters
- Usable for wide viewing angle requirements
- Usable in vibrating environment, impervious to vibration

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C ambient	750 mW
Derate linearly from 25°C	10 mW/°C
Storage and operating temp	-55°C to 100°C
Continuous forward current	
Total	240 mA
Per segment	30 mA
Decimal point	30 mA
Reverse Voltage	
Per segment	6.0 volts
Decimal point	3.0 volts

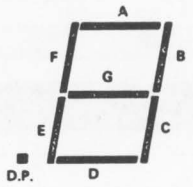
ELECTRO-OPTICAL CHARACTERISTICS

(25°C Ambient Temperature Unless Otherwise Specified)

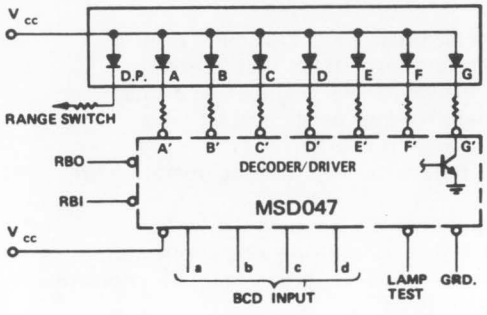
CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1)					
Segment	100	350		ft-L	I_F=20 mA, λ=6550 Å
Decimal point	100	350		ft-L	I_F=20 mA, λ=6550 Å
Peak emission wave length	6300		7000	Å	
Spectral line half width		400		Å	
Forward voltage					
Segment		3.4	4.0	V	I_F=20 mA
Decimal point		1.6	2.0	V	I_F=20 mA
Dynamic resistance					
Segment		11		Ω	I_F=20 mA
Decimal point		5.5		Ω	I_F=20 mA
Capacitance					
Segment		80		pF	V=0
Decimal point		135		pF	V=0
Reverse current					
Segment			100	μA	V_R=6.0 V
Decimal point			100	μA	V_R=3.0 V

MANIA MANIB

DECODER/DRIVER FUNCTIONAL DIAGRAM



Monsanto MAN 1A, MAN 1B



TYPICAL TRUTH TABLE

INPUT CODE				OUTPUT STATE							DISPLAY
d	c	b	a	A'	B'	C'	D'	E'	F'	G'	
0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	1	1	0	0	1	1	1	1	1
0	0	1	0	0	0	1	0	0	1	0	2
0	0	1	1	0	0	0	0	1	1	0	3
0	1	0	0	1	0	0	1	1	0	0	4
0	1	0	1	0	1	0	0	1	0	0	5
0	1	1	0	1	1	0	0	0	0	0	6
0	1	1	1	0	0	0	1	1	1	1	7
1	0	0	0	0	0	0	0	0	0	0	8
1	0	0	1	0	0	0	1	1	0	0	9

TYPICAL CURVES

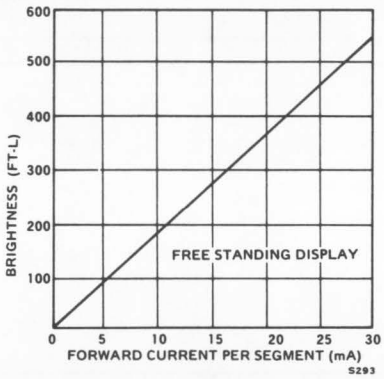


Figure 1 Brightness vs. Forward Current

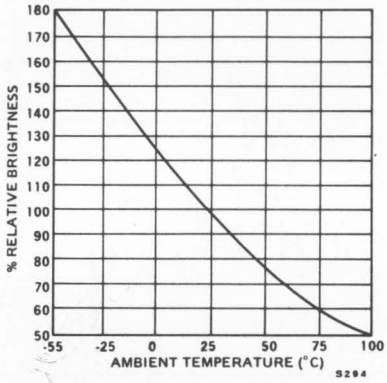


Figure 2 Brightness vs. Temperature

TYPICAL THERMAL CHARACTERISTICS

Thermal Resistance (note 4) Junction to free air Θ_{JA} . . . . . .440°C/W
Wavelength Temperature Coefficient (case temp) . . . . . 3.0 Å/°C
Forward Voltage Temperature Coefficient . . . . . .-4.0 mV/°C

NOTES

1. *As measured with a Photo Research Spectra Microcandela Meter corrected for wavelength error. Brightness cannot vary more than ±50% between all segments.*
2. *The curve in Figure 2 is normalized to the brightness at 25° C to indicate the relative efficiency over the operating temperature range.*
3. *For contrast improvement Polaroid HRCP7 circular polarizer filter can be used. Non-glare circular polarizer filter will provide further enhancement in display visibility.*
4. *Thermal resistance (junction to ambient) value of any one segment with all segments in operation.*

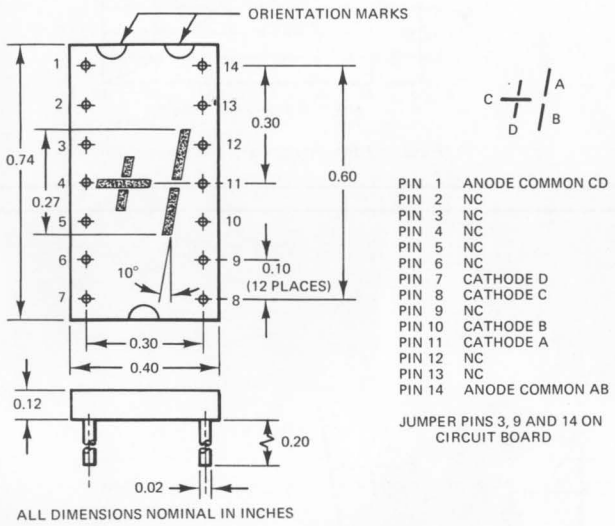
Monsanto

POLARITY & OVERFLOW DISPLAY | MAN1001

PRODUCT DESCRIPTION

The MAN1001 is a visible, monochromatic red, polarity and overflow display made of diffused planar gallium arsenide phosphide. It is epoxy encapsulated and plug-into a standard DIP socket.

PACKAGE DIMENSIONS



PIN 1 ANODE COMMON CD
PIN 2 NC
PIN 3 NC
PIN 4 NC
PIN 5 NC
PIN 6 NC
PIN 7 CATHODE D
PIN 8 CATHODE C
PIN 9 NC
PIN 10 CATHODE B
PIN 11 CATHODE A
PIN 12 NC
PIN 13 NC
PIN 14 ANODE COMMON AB

JUMPER PINS 3, 9 AND 14 ON CIRCUIT BOARD

ALL DIMENSIONS NOMINAL IN INCHES

DUAL, IN-LINE CONFIGURATION

FEATURES & APPLICATIONS

- High brightness - typically 350 ft-L @ 20 mA
- Single plane, wide angle viewing - 150°
- Unobstructed emitting surface
- Standard 14 pin dual-in-line package configuration
- Long operating life - solid state reliability
- Shock resistant
- Operates with IC voltage requirements
- Small size offering unique styling advantages

◆

It is ideal for industrial and military applications such as:

- Digital readout displays
- Cockpit readout displays
- Directly compatible with integrated circuits
- Usable for wide viewing angle requirements
- Usable in vibrating environment, impervious to vibration

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25°C	480 mW
Derate linearly from 25°C	6.4 mW/°C
Storage and operating temperature	-55°C to 100°C
Continuous forward current	
Total	120 mA
Per segment	30 mA
Reverse voltage	
Per segment	6.0 volts

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1) segment	100	350		ft-L	I_F=20 mA, λ=6550 Å
Peak emission wave length	6300		7000	Å	
Spectral line half width		400		Å	
Forward voltage segment		3.4	4.0	V	I_F=20 mA
Dynamic resistance		11		Ω	I_F=20 mA
Capacitance segment		80		pF	V=0
Reverse current segment			100	μA	V_R=6.0 V

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TYPICAL THERMAL CHARACTERISTICS

Thermal resistance (note 4) junction to free air Θ_{JA} . . . . . 440°C/W
Wavelength temperature coefficient (case temperature) . . . . . 3.0Å/°C
Forward voltage temperature coefficient . . . . . -3.0 mV/°C

TYPICAL CURVES (25°C Free Air Temperature Unless Otherwise Specified)

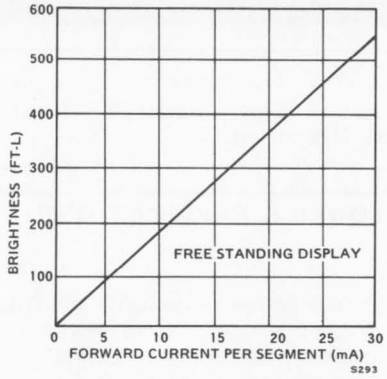


Figure 1 Brightness vs. Forward Current

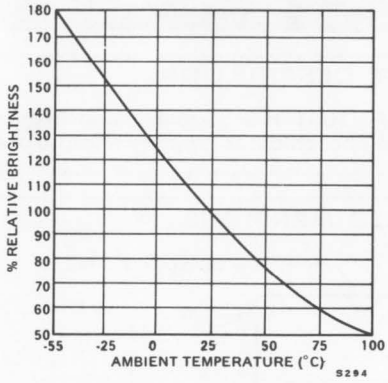
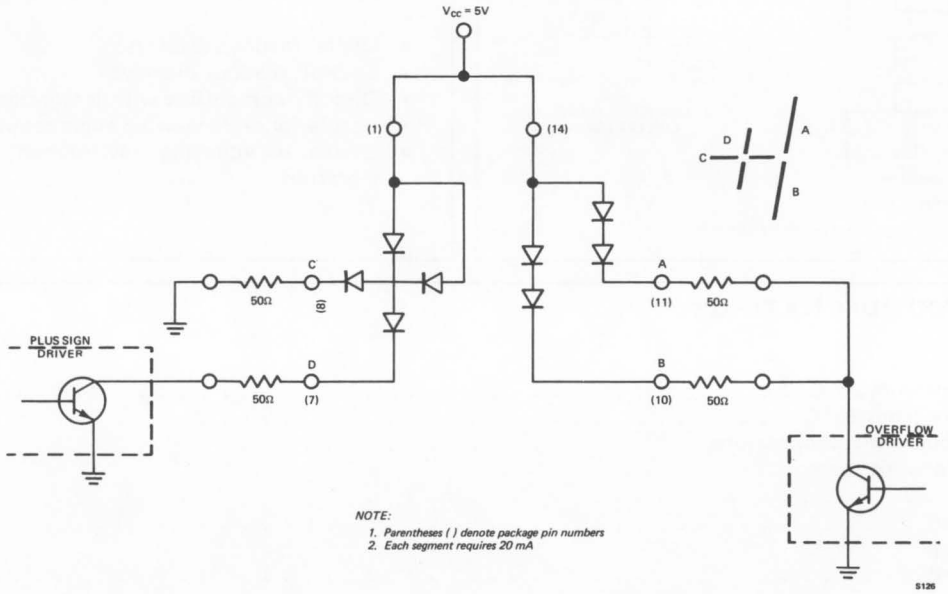


Figure 2 Brightness vs. Temperature

DRIVING CIRCUITRY FOR THE MAN1001



NOTES

1. *As measured with a Photo Research Spectra Microcandela Meter corrected for wavelength error. Brightness cannot vary more than ±50% between all segments.*
2. *The curve in Figure 2 is normalized to the brightness at 25°C to indicate the relative efficiency over the operating temperature range.*
3. *For contrast improvement Polaroid HRCO7 circular polarizer filter can be used. Non-glare circular polarizer filter will provide further enhancement is display visibility.*
4. *Thermal resistance (junction to ambient) value of any one segment with all segments in operation.*

Monsanto

ALPHA-NUMERIC DISPLAY

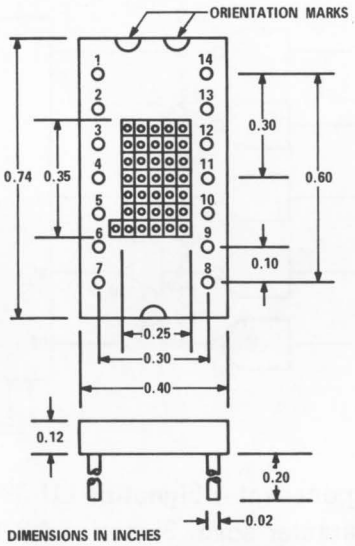
MAN2

PRODUCT DESCRIPTION

The MAN2 is a 35 diode alpha-numeric display with decimal point. It is made of diffused planar gallium arsenide phosphide diodes mounted on a dual in-line, 14 pin substrate with a clear epoxy lens. It is capable of displaying the 64 character ASCII code.

PACKAGE DIMENSIONS

		ROW-COLUMN	BIAS
PIN	1	COLUMN 2,	+
PIN	2	ROW 1,	–
PIN	3	ROW 3,	–
PIN	4	ROW 4,	–
PIN	5	COLUMN 1,	+
PIN	6	N.C.	
PIN	7	D.P.	+
PIN	8	COLUMN 3,	+
PIN	9	ROW 7,	–
PIN	10	ROW 6,	–
PIN	11	ROW 5,	–
PIN	12	ROW 2,	–
PIN	13	COLUMN 5,	+
PIN	14	COLUMN 4,	+



DIMENSIONS IN INCHES

DUAL, IN-LINE CONFIGURATION

FEATURES & APPLICATIONS

- Visible, bright red, high contrast display
- 36 light emitting diodes including decimal point
- Capable of displaying 64 ASCII characters
- Single plane, wide angle viewing
- Long life, shock resistant, small size

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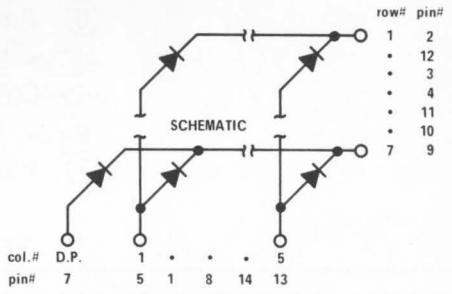
- Keyboard verifier
- Film annotation - 2^{36} bits available
- Avionics display
- Computer peripheral displays

ABSOLUTE MAXIMUM RATINGS

DC forward current (total)	400 mA
DC forward current (per diode)	20 mA
Pulsed forward current (50μs 20% duty cycle)	100 mA
Power dissipation @25°C ambient	750 mW
Reverse voltage	3 volts
Storage and operating temperature	-55°C to 100°C
Derate linearly from 25°C	10 mW/°C

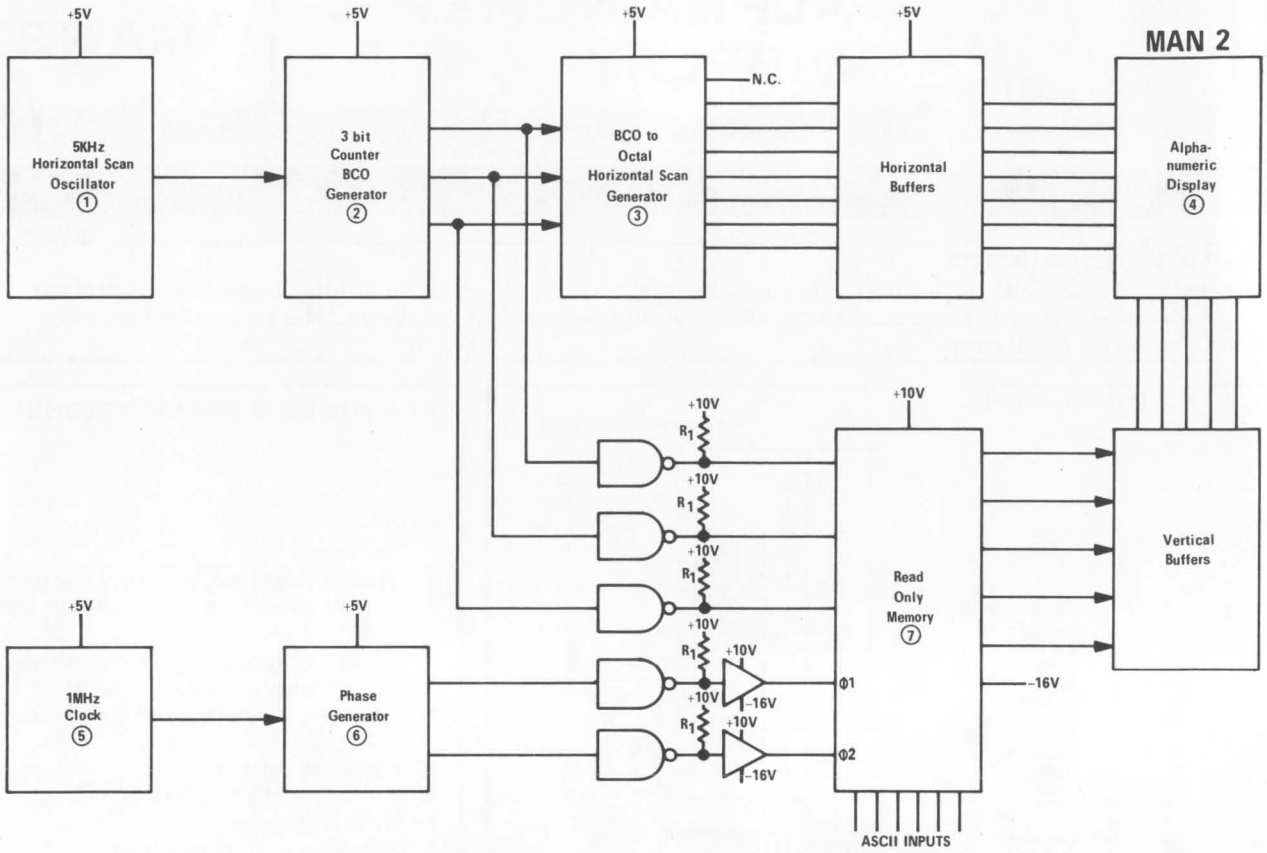


ELECTRO-OPTICAL CHARACTERISTICS (PER DIODE)

(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITION
Brightness		300		ft-L	I_F=10 mA
Peak emission wavelength	6300	6500		Å	
Spectral line half width		400		Å	
Forward voltage		1.7		V	I_F=10 mA
Capacitance		200		pF	V=0
Reverse current			100	μA	V_R=3 V

MAN2



① 3 stage ring oscillator Signetics LU-380A
② For ROM character scan. Signetics N8280A
③ For MAN-2 row scan. Signetics N8250A
④ Alphanumeric Display. Monsanto MAN 2
⑤ 3 stage ring oscillator Signetics LU-380A
⑥ Provides Φ1, Φ2 for ROM Signetics LU-322B and N8470A
Logic level interface gate 1/6 Signetics N8T90A
Clock driver Cermetek CH1032
R_1 2K, 1/4w, ±5% composition resistor
⑦ Electronic Arrays EA-3501-1

5x7 x–y ADDRESS FUNCTIONAL DIAGRAM

The above circuit will display the 64 ASCII characters.

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

@ - $ & ! # * , . + – / ; = ? : " % ' \ [ ] > < ( ) ^

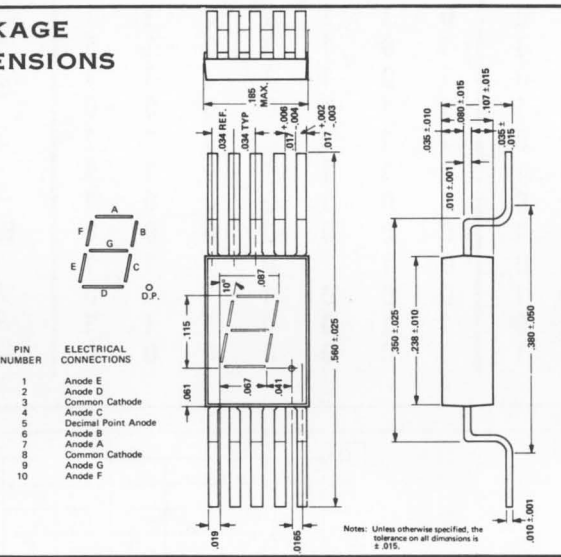
Refer to Electronic Arrays Inc. EA3501 data sheet for bit pattern and font table.

Monsanto ALPHA-NUMERIC DISPLAY | MAN3

PRODUCT DESCRIPTION

The MAN3 is a monolithic seven-segment diffused planar gallium arsenide phosphide readout. It is capable of displaying 10 digits and 9 distinct letters and is encapsulated in clear epoxy.

PACKAGE DIMENSIONS



PIN NUMBER	ELECTRICAL CONNECTIONS
1	Anode E
2	Anode D
3	Common Cathode
4	Anode C
5	Decimal Point Anode
6	Anode B
7	Anode A
8	Common Cathode
9	Anode G
10	Anode F

FEATURES & APPLICATIONS

- Bright red, 400 ft-L at 10 mA per segment
- Visible as low as 1 mA, 1.65 V per segment
- Compact spacing (16 digits in 3 inches width)
- Wide angle (150°), single plane viewing
- Compatible with IC's
- Planar monolithic, frame lead construction
- Long operating life . . . . solid state reliability
- Shock resistant
- Displays 0 to 9 plus A,C,E,F,H,J,L,P, & U
- Low Cost

◆

Applications for the MAN 3 in computer, industrial, avionic and military markets are:

- Digital displays for desk calculators
- Instruments and portable equipment
- Film annotation
- All digital displays

ABSOLUTE MAXIMUM RATINGS

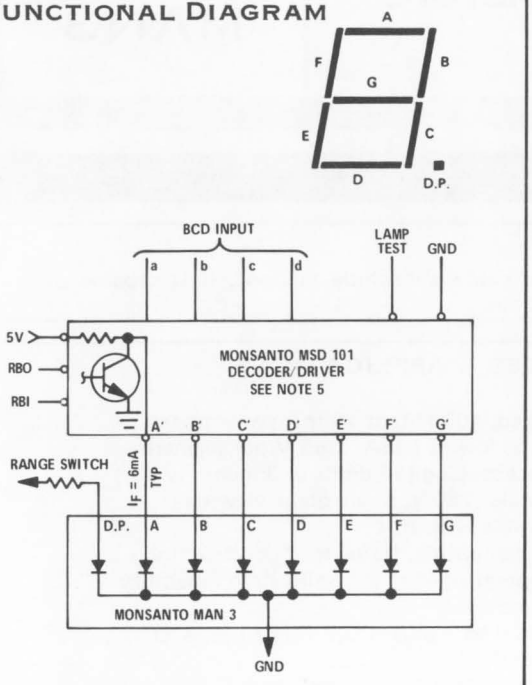
Power dissipation @ 25°C ambient	160 mW
Derate linearly from 25°C	2.67 mW/°C
Storage and operating temp	-55°C to 85°C
Continuous Forward Current	
Total	80 mA
Per segment	10 mA
Decimal point	10 mA
Reverse Voltage	
Per segment	3 volts
Decimal point	3 volts

ELECTRO-OPTICAL CHARACTERISTICS (25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1)					
Segment	100	200		ft-L	I_F = 5 mA
Decimal Point	100	200		ft-L	I_F = 5 mA
Peak Emission Wave Length	6300		7000	Å	
Spectral Line Half Width		400		Å	
Forward Voltage					
Segment		1.7	2.0		I_F = 5 mA
Decimal Point		1.7	2.0		I_F = 5 mA
Dynamic Resistance					
Segment		30		Ω	I_F = 5 mA
Decimal Point		15		Ω	I_F = 5 mA
Capacitance					
Segment		25		pF	V = 0, f = 1 MHz
Decimal point		25		pF	V = 0, f = 1 MHz
Reverse Current					
Segment			100	μA	V_R = 3.0 volts
Decimal Point			100	μA	V_R = 3.0 volts

MAN3

Decoder/Driver Functional Diagram



DECODER/DRIVER, FUNCTIONAL DIAGRAM

Truth Table

TRUTH TABLE FOR MONSANTO MSD 101

INPUT CODE				OUTPUT STATE							DISPLAY
d	c	b	a	A'	B'	C'	D'	E'	F'	G'	
0	0	0	0	1	1	1	1	1	1	0	0
0	0	0	1	0	1	1	0	0	0	0	1
0	0	1	0	1	1	0	1	1	0	1	2
0	0	1	1	1	1	1	1	0	0	1	3
0	1	0	0	0	1	1	0	0	1	1	4
0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	0	1	1	1	1	1	6
0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	0	1	1	1	1	1	1	1	8
1	0	0	1	1	1	1	1	0	1	1	9
1	0	1	0	0	0	0	0	0	0	1	-
1	0	1	1	0	0	0	0	0	0	0	BLANK
1	1	0	0	0	1	1	0	1	1	1	H
1	1	0	1	0	0	0	1	1	1	0	L
1	1	1	0	1	1	0	0	1	1	1	P
1	1	1	1	0	0	0	0	0	0	0	BLANK

Typical Curves

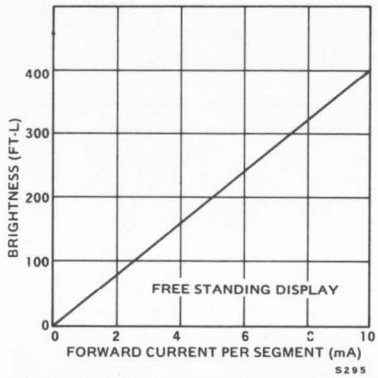


Figure 1 Brightness vs. Forward Current

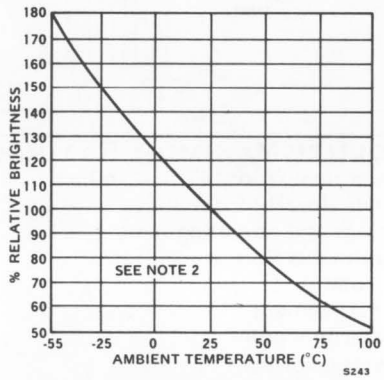


Figure 2 Brightness vs. Temperature

Typical Characteristics

Thermal Resistance (note 4) Junction to free air Θ_{JA} . . . . . 240°C/W
Wavelength Temperature Coefficient (case temp) . . . . . 3.0 Å/°C
Forward Voltage Temperature Coefficient . . . . . -2.0 mW/°C

Notes

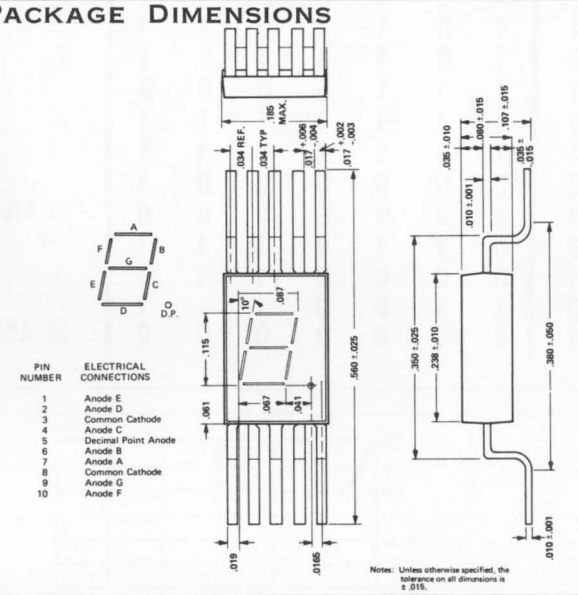
1. *As measured with a Photo Research Spectra Microcandela Meter corrected for wavelength error. Brightness cannot vary more than ±50% between all segments.*
2. *The curve in Figure 2 is normalized to the brightness of 25°C to indicate the relative efficiency over the operating temperature range.*
3. *For contrast improvement Polaroid HRCP7 circular polarizer filter can be used. Non-glare circular polarizer filter will provide further enhancement in display visibility.*
4. *Thermal resistance (junction to ambient) value of any one segment with all segments in operation.*
5. *Refer to product data sheet for more detailed information on the Monsanto MSD 101 decoder/driver.*

Monsanto ALPHA-NUMERIC DISPLAY | MAN3A

PRODUCT DESCRIPTION

The MAN3A is a hybrid monolithic, seven segment diffused planar gallium arsenide phosphide readout. It is capable of displaying 10 digits and 9 distinct letters and is encapsulated in a red epoxy package.

PACKAGE DIMENSIONS



PIN NUMBER	ELECTRICAL CONNECTIONS
1	Anode E
2	Anode D
3	Common Cathode
4	Anode C
5	Decimal Point Anode
6	Anode B
7	Anode A
8	Common Cathode
9	Anode G
10	Anode F

Notes: Unless otherwise specified, the tolerance on all dimensions is ± .015.

FEATURES & APPLICATIONS

- 0.115 high LED 7-segment display
- Bright red 400 ft-L at 10mA per segment
- Red lens for improved contrast ratio
- Compact spacing 5 digits per inch
- Wide viewing angle, single plane display
- Compatible with standard digital IC's
- Solid state reliability for long operating life
- Displays all numbers and nine letters
- Pulse tested for multiplexing applications
- Low cost

◆

- Digital displays for desk calculators
- Instruments and portable equipment
- Film annotation
- All digital displays

ABSOLUTE MAXIMUM RATINGS

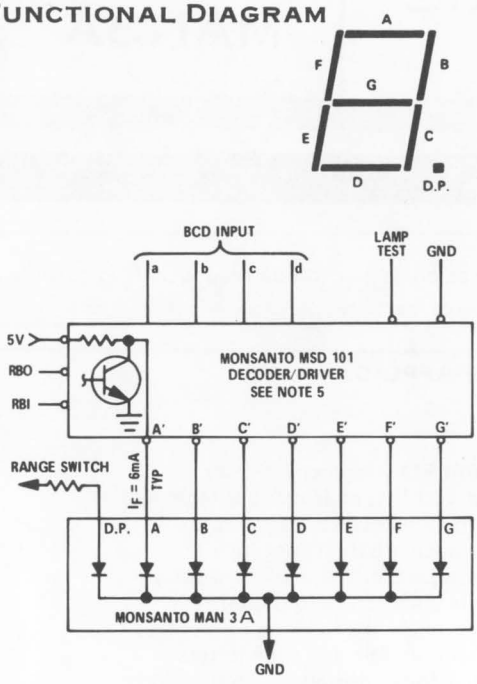
Power dissipation @ 25°C ambient	160 mW
Derate linearly from 25°C	2.67 mW/°C
Storage and operating temp	-55°C to 85°C
Continuous forward current	
Total	80 mA
Per segment	10 mA
Decimal point	10 mA
Reverse voltage	
Per segment	3 volts
Decimal point	3 volts

ELECTRO-OPTICAL CHARACTERISTICS (25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1)					
Segment	100	200		ft-L	I_F=5 mA
Decimal point	100	200		ft-L	I_F=5 mA
Peak emission wave length	6300		7000	Å	
Spectral line half width		400		Å	
Forward voltage					
Segment		1.7	2.0		I_F=5 mA
Decimal point		1.7	2.0		I_F=5 mA
Dynamic resistance					
Segment		30		Ω	I_F=5 mA
Decimal point		15		Ω	I_F=5 mA
Capacitance					
Segment		25		pF	V=0, f=1 MHz
Decimal point		25		pF	V=0, f=1 MHz
Reverse current					
Segment			100	μA	V_R=3.0 V
Decimal point			100	μA	V_R=3.0 V

MAN3A

DECODER/DRIVER FUNCTIONAL DIAGRAM



DECODER/DRIVER, FUNCTIONAL DIAGRAM

TRUTH TABLE

TRUTH TABLE FOR MONSANTO MSD 101

INPUT CODE				OUTPUT STATE							DISPLAY
d	c	b	a	A'	B'	C'	D'	E'	F'	G'	
0	0	0	0	1	1	1	1	1	1	0	0
0	0	0	1	0	1	1	0	0	0	0	1
0	0	1	0	1	1	0	1	1	0	1	2
0	0	1	1	1	1	1	1	0	0	1	3
0	1	0	0	0	1	1	0	0	1	1	4
0	1	0	1	1	0	1	1	0	1	1	5
0	1	1	0	1	0	1	1	1	1	1	6
0	1	1	1	1	1	1	0	0	0	0	7
1	0	0	0	1	1	1	1	1	1	1	8
1	0	0	1	1	1	1	1	0	1	1	9
1	0	1	0	0	0	0	0	0	0	1	
1	0	1	1	0	0	0	0	0	0	0	BLANK
1	1	0	0	0	1	1	0	1	1	1	H
1	1	0	1	0	0	0	1	1	1	0	L
1	1	1	0	1	1	0	0	1	1	1	P
1	1	1	1	0	0	0	0	0	0	0	BLANK

TYPICAL CURVES

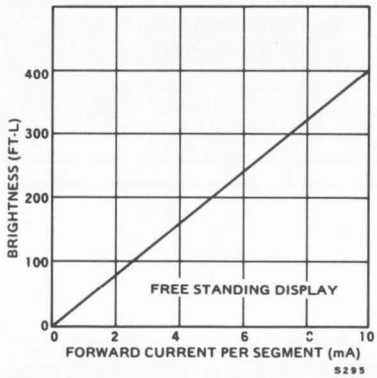


Figure 1 Brightness vs. Forward Current

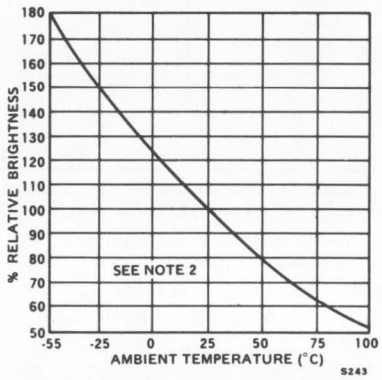


Figure 2 Brightness vs. Temperature

TYPICAL CHARACTERISTICS

Thermal Resistance (note 4) Junction to free air Θ_{JA}	240°C/W
Wavelength Temperature Coefficient (case temp)	3.0 Å/°C
Forward Voltage Temperature Coefficient	-2.0 mW/°C

NOTES

1. *As measured with a Photo Research Spectra Microcandela Meter corrected for wavelength error. Brightness cannot vary more than ±50% between all segments.*
2. *The curve in Figure 2 is normalized to the brightness of 25°C to indicate the relative efficiency over the operating temperature range.*
3. *For contrast improvement Polaroid HRCP7 circular polarizer filter can be used. Non-glare circular polarizer filter will provide further enhancement in display visibility.*
4. *Thermal resistance (junction to ambient) value of any one segment with all segments in operation.*
5. *Refer to product data sheet for more detailed information on the Monsanto MSD 101 decoder/driver.*

Monsanto

ALPHA-NUMERIC DISPLAYS

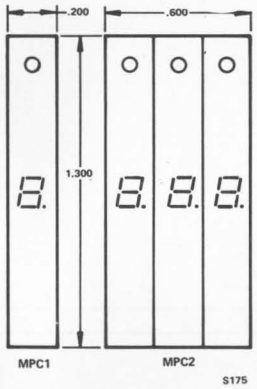
MPC1 MPC2 MPC3

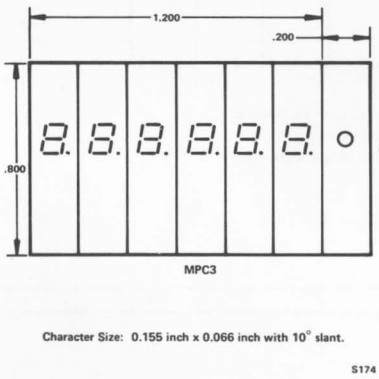
PRODUCT DESCRIPTION

The MPC1 and MPC2 are individually addressable circuit boards specifically designed to adapt the MAN3 for mounting and connection to other circuit components. Each segment of the numeric can be addressed independently.

The MPC3 contains 6 MAN3 and is X-Y addressable. The corresponding segments of each numeric are connected in parallel for multiplexing the numerics. Individual cathodes and decimal connections are provided for each numeric.

PACKAGE DIMENSIONS





ABSOLUTE MAXIMUM RATINGS

Power dissipation @25°C ambient	.160mW
Derate linearly from 25°C	2.67 mW/°C
Storage and operating temperature	-55°C to 85°C
Continuous forward current	
Total	80mA
Per segment or decimal point	10mA
Peak forward current (10% duty cycle)	
Per segment or decimal point	50mA
Reverse voltage	
Per segment or decimal point	3 volts

FEATURES

- Bright red, 200 ft-L at 5.0 mA per segment
- Visible as low as 1 mA, 1.65 V per segment
- Uniform brightness
- Wide angle (150°) single plane viewing
- Compatible with IC's
- Planar monolithic, frame lead construction
- Long operating life . . . solid state reliability
- Shock resistant
- Displays 0 to 9 plus A,C,E,F,H,J,L,P, and U
- Low Cost
- Printed circuit board pads with 0.100 inch centers
- Compact spacing (5 digits per inch)

◆

Applications for the MPC1, MPC2 and MPC3 in computer, industrial avionic and military markets are:

- Digital displays for desk calculators
- Instruments and portable equipment
- Film annotation
- All digital displays

MPC 1 & MPC 2 — Individually addressable printed circuit boards are specifically designed to adapt the MAN-3 for mounting and connection to other circuit components. Each segment of the numeric can be addressed independently.

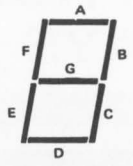
MPC 3 — X-Y addressable printed circuit board are specifically designed to adapt the MAN-3 for mounting and connection to other circuit components. The corresponding segments of each numeric are connected in parallel for multiplexing the numerics. Individual cathodes and decimal connections are provided for each numeric.

ELECTRO-OPTICAL CHARACTERISTICS

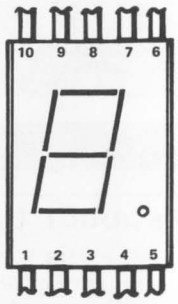
(25°C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1) segment or decimal point	100	200		ft-L	I_F=5 mA
Peak emission wave length	6300	6500	7000	Å	
Spectral line half width		400		Å	
Forward voltage segment or decimal point		1.7	2.0	V	I_F=5 mA
Dynamic resistance segment or decimal point		30		Ω	I_F=5 mA
Capacitance segment or decimal point		25		pF	V=0, f=1 MHz
Reverse current segment or decimal point			100	μA	V_R=3.0 V

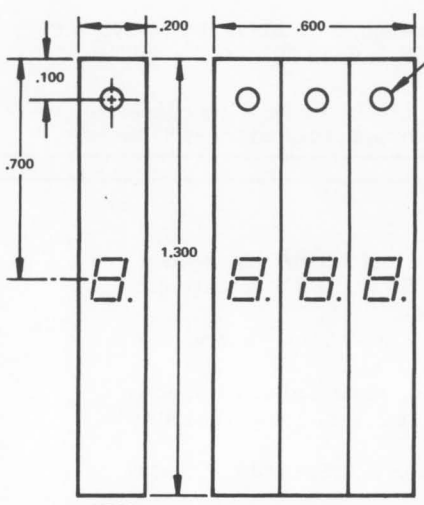
MPC1 MPC2 MPC3



Pin Number	Electrical Connection
1	Anode E
2	Anode D
3	Common Cathode
4	Anode C
5	Decimal Point Anode
6	Anode B
7	Anode A
8	Common Anode
9	Anode G
10	Anode F

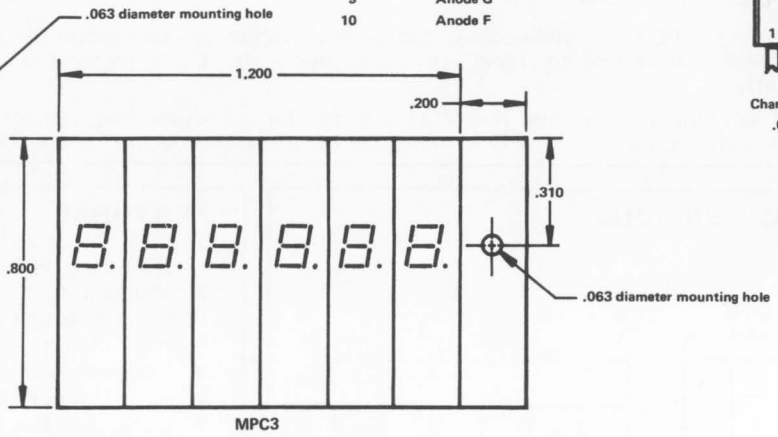


Character Size: 0.115 inch x .066 inch with 10° slant.



MPC1 MPC2

Individually addressable numerics.



MPC3

Corresponding segments of each numeric are connected in parallel. Individual cathodes and decimal point connections are provided.

SUBSTRATE DESCRIPTION

All MPC 1, MPC 2, and MPC 3 are made of Nema Grade G-10 copper clad glass/epoxy laminates.

Peel strength	10 lbs./inch
Volume resistivity	3.8×10^8 megohm-cm
Surface resistance	4.5×10^6 megohm-cm
Water absorption	0.10%
Dielectric breakdown, s/s parallel	64.0 KV
Dielectric constant	5.0
Dissipation factor	.0.021
Flexural Strength	68,000 P.S.I.
Maximum Thickness	0.100 inch
Copper cladding weight	1.0 oz.
Color	Black and Opaque

NOTES

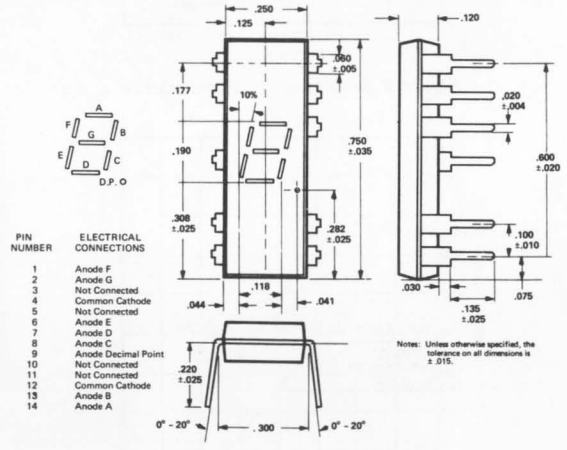
1. *As measured with a Photo Research Spectra Microcandela Meter corrected for wavelength error.*
2. *When soldering wires to MPC 1 and MPC 2 care must be taken not to re-melt the tin-lead solder (60/40, melting point 183°C) that connects the leads of the MAN 3 display to the printed circuit board.*

Monsanto

ALPHA-NUMERIC DISPLAY

MAN4

PACKAGE DIMENSIONS



PIN NUMBER	ELECTRICAL CONNECTIONS
1	Anode F
2	Anode G
3	Not Connected
4	Common Cathode
5	Not Connected
6	Anode E
7	Anode D
8	Anode C
9	Anode Decimal Point
10	Not Connected
11	Not Connected
12	Common Cathode
13	Anode B
14	Anode A

Notes: Unless otherwise specified, the tolerance on all dimensions is ± .015.

FEATURES & APPLICATIONS

- 0.190 inch height LED, 7-segment display
- Low cost
- Bright red 400 ft-L at 10 mA per segment
- Red lens for improved contrast ratio
- Compact spacing - 0.35 inch center-to-center
- Wide viewing angle
- Compatible with standard digital IC's
- Solid state reliability for long operating life
- Shock resistant
- Display 0 through 9 and nine letters
- Pulse tested for multiplexing application

◆

- Digital displays for desk calculators
- Instruments and portable equipment
- Film annotation
- All digital displays

ABSOLUTE MAXIMUM RATINGS

Power dissipation @ 25 C ambient 280mW
Derate linearly from 25 C . . . . . .8 mW/°C
Storage and operating temp . . . . . -55°C to 85°C
Continuous forward current
- Total 120mA
- Per segment 15mA
- Decimal point 15mA

Reverse Voltage
- Per segment . . . . . 3 volts
- Decimal point . . . . . 3 volts

ELECTRO-OPTICAL CHARACTERISTICS

(25° C Ambient Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Brightness (note 1)					
Segment	100	200		ft-L	I_F=5 mA
Decimal point	100	200		ft-L	I_F=5 mA
Segment	200	400		ft-L	I_F=10 mA
Decimal point	200	400		ft-L	I_F=10 mA
Peak emission wave length	6300		7000	Å	
Spectral line half width		400		Å	
Forward voltage					
Segment		1.7	2.0		I_F=5 mA
Decimal point		1.7	2.0		I_F=5 mA
Dynamic resistance					
Segment		7		Ω	I_F=10 mA
Decimal point		7		Ω	I_F=10 mA
Capacitance					
Segment		50		pF	V=0, f=1 MHz
Decimal point		50		pF	V=0, f=1 MHz
Reverse current					
Segment			100	μA	V_R=3.0 V
Decimal point			100	μA	V_R=3.0 V

MAN4

TYPICAL CURVES (25°C Free Air Temperature Unless Otherwise Specified)

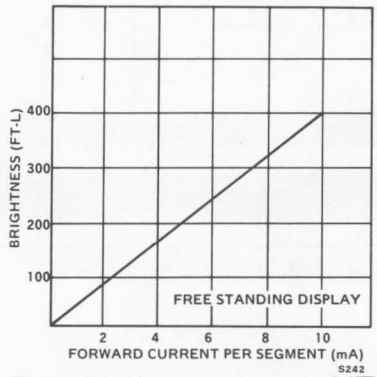


Figure 1 Brightness vs Forward Current

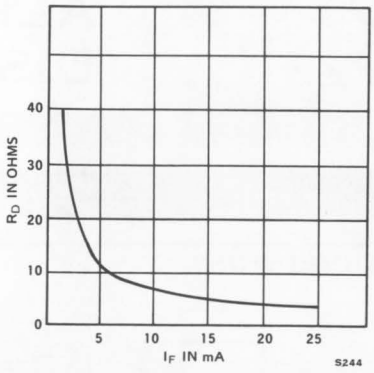


Figure 2 Brightness vs Temperature

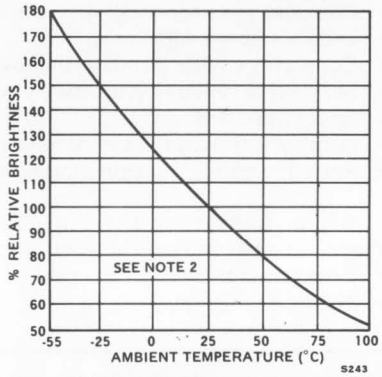


Figure 3 Typical Dynamic Resistance (R_D) vs Forward Current (I_F)

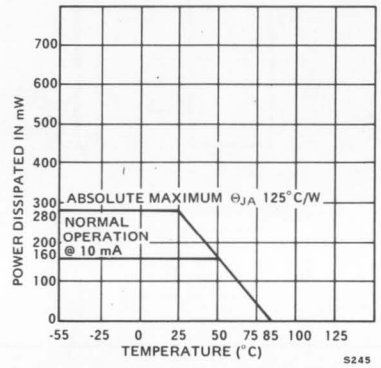
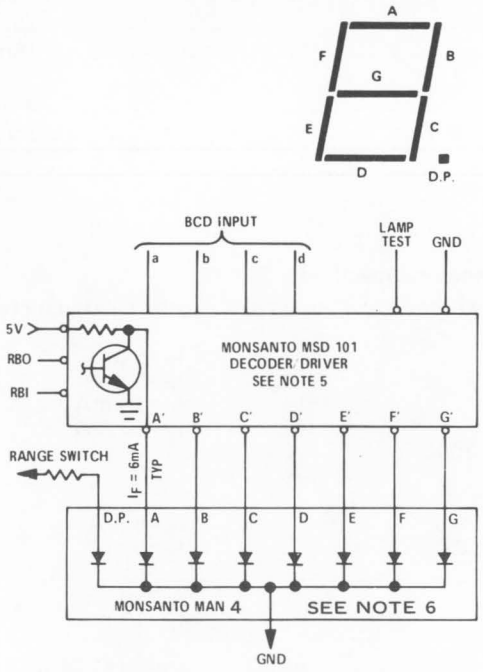


Figure 4 Power Dissipation vs Ambient Temperature

DECORDER/DRIVER FUNCTIONAL DIAGRAM



DECODER/DRIVER, FUNCTIONAL DIAGRAM

TYPICAL CHARACTERISTICS

Thermal Resistance (note 4) Junction to free air Θ_{JA} . 125°C/W

Wavelength Temperature Coefficient (case temp) .....3.0 Å/°C

Forward Voltage Temperature coefficient .....-2.0 mV/°C

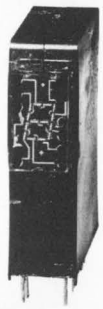
NOTES

1. *As measured with a Photo Research spectra microcandela meter corrected for wavelength error. Brightness cannot vary more than 25% between all segments.*
2. *The curve in Figure 2 is normalized to the brightness of 25°C to indicate the relative efficiency over the operating temperature range.*
3. *For contrast improvement Polaroid HRCP7 circular polarizer filter can be used. Non-glare circular polarizer filter will provide further enhancement in display visibility.*
4. *Thermal resistance (junction to ambient) value of any one segment with all segments in operation.*
5. *Refer to product data sheet for more detailed information on the Monsanto MSD 101 decoder/driver.*
6. *For high ambient light level applications, external resistors may be added in parallel with the MSD101 internal drive resistors. For example current may be increased from 5 mA to 10 mA by adding 650Ω segment resistors from V_{CC} to the MAN 4 segment contacts.*

Monsanto

ALPHA-NUMERIC MODULE DISPLAYS

MDA100 MDA101 MDA301



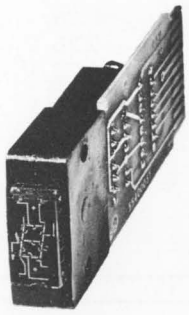
MDA100

FEATURES

- High brightness . . . typically 350 ft-L @ 5 V
- Single plane, wide angle viewing . . 150°
- Standard 14 pin dual-in-line socket module
- Built-in resistors
- Long operating life . . . solid state reliability
- Shock resistant
- Compatible with IC logic
- Small size; offering unique styling advantages
- Can be mounted on 0.5" centers

PRODUCT DESCRIPTION

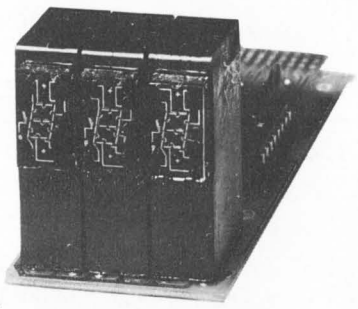
The MDA100 is a compact single digit display module that requires minimum space when installed. The Monsanto MSD047 four-line BCD decoder/driver is recommended to be used with MDA100.



MDA101

- Single digit display
- Built in decoder/driver
- BCD inputs are compatible with DTL and TTL logic
- Compatible with IC voltage requirements
- High brightness . . . typically 350 ft-L @ 5 V
- Unobstructed emitting surface
- Shock resistant
- Small size; offering unique styling advantages
- Can be mounted on 0.5" centers
- Single plane, wide angle viewing . . . 150°
- Lamp test
- Long operating life . . . solid state reliability

The MDA101 is a single-digit display module that requires minimum space when installed. The decoder/driver is designed to accept four input BCD (8, 4, 2, 1) code and provides visual readout of decimal numbers. The MDA101 provides a decimal point input and has ripple-blanking input and blanking input/ripple-blanking output terminals for zero suppression and intensity control.



MDA301

- Multi-digit display
- Built in decoder/driver
- BCD inputs are compatible with DTL and TTL logic
- Compatible with IC voltage requirements
- High brightness . . . typically 350 ft-L @ 5 V
- Unobstructed emitting surface
- Shock resistant
- Small size; offering unique styling advantages
- Single plane, wide angle viewing . . . 150°
- Lamp test
- Long operating life . . solid state reliability

The MDA301 is a multi-digit display module that requires minimum space when installed. The decoder/drivers are designed to accept four input BCD (8, 4, 2, 1) code and provides visual readout of decimal numbers.

APPLICATIONS

The MDA series modular assemblies utilize the MAN1 seven segment alpha-numeric display having a character height of 0.270 inches. These modules are intended for industrial, computer, avionic and military system applications requiring:

- Digital readout displays
- Cockpit readout displays
- Directly compatible with integrated circuits
- All numbers plus 9 distinct letters
- Usable for wide viewing angle requirements
- Usable in vibrating environment, impervious to vibration
- Save time and money
- Design work and assembly already done

ELECTRICAL CHARACTERISTICS (MDA101 & MDA301)

	PARAMETER	MIN.	MAX.	UNITS	TEST CONDITIONS
V_{IH}	Input voltage required to ensure logical 1 at any input	2		V	V_{CC}=4.75
V_{IL}	Input voltage required to ensure logical 0 at any input except BI/RBO		0.8	V	V_{CC}=4.75
I_{IL}	Logical 0 level input current at any input except BI/RBO		-1.6	mA	V_{CC}=5.25, V_{IN}=0.4 V
*$I_{IL(RBO)}$	Logical 0 level input current at BI/RBO		-4.2	mA	V_{CC}=5.25, V_{IN}=0.4 V
I_{IH}	Logical 1 level input current at any input except BI/RBO		1	mA	V_{CC}=5.25, V_{IN}=5.5 V

* applicable for MDA101 only

ABSOLUTE MAXIMUM RATINGS

Supply voltage, V_{CC} (MDA 100, MDA 101, MDA 301) 5.5V
Logic input voltage, V_{IN} (MDA 101, MDA 301) 5.5V
Operating temperature (MDA 100) . . . . . -55°C to 100°C
Operating temperature (MDA 101, MDA 301) . . . . . 0°C to 70°C
Storage temperature (MDA 100, MDA 101, MDA 301) . . . . . -55°C to 100°C
Reverse voltage (MDA 100)
Per segment 6.0V
Decimal point 3.0V

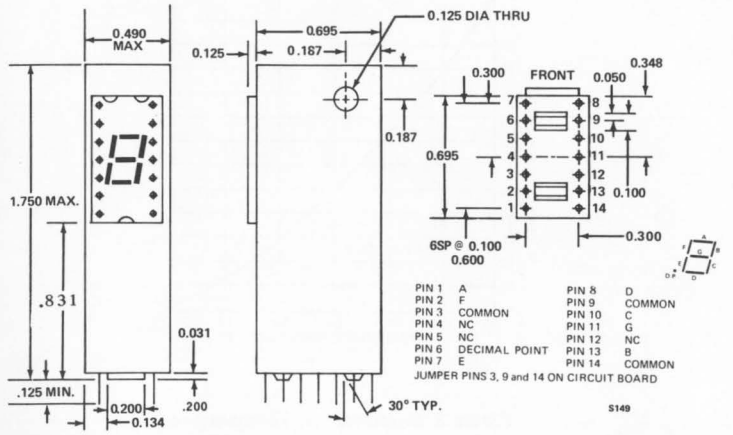
TYPICAL ELECTRO-OPTICAL CHARACTERISTICS (MDA100, MDA101, & MDA301)

(25°C Free Air Temperature Unless Otherwise Specified)

Brightness
Segment 350 ft-L . . . . . V_{CC} = 5V, λ = 6500 Å
Decimal point 350 ft-L . . . . . V_{CC} = 5V, λ = 6500 Å
Peak emission wavelength . . . . . 6500 Å
Spectral line half width . . . . . 400 Å

MDA100 MDA101 MDA301

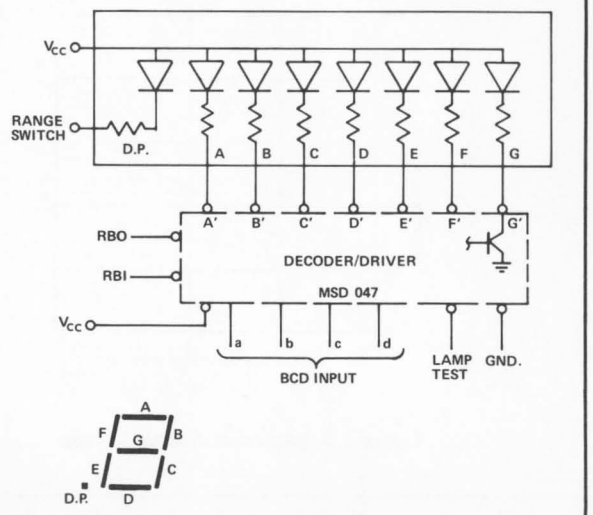
MDA100 Package Dimensions



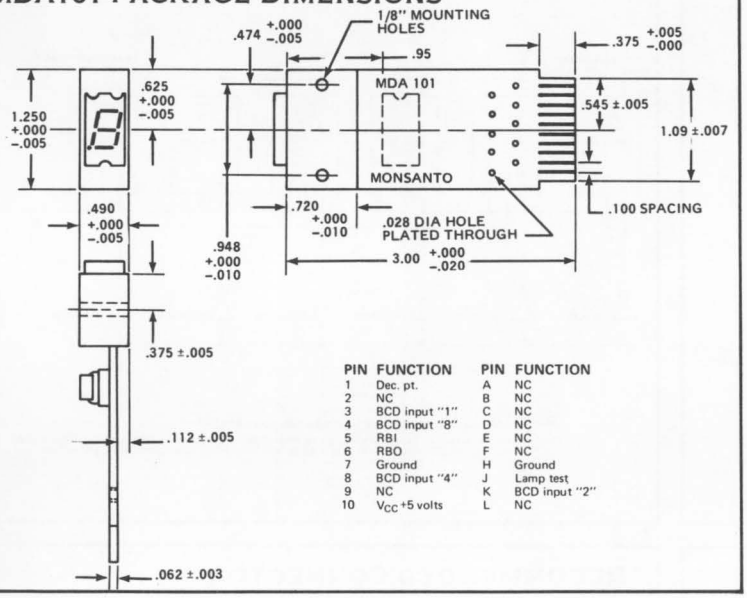
PIN 1	A	PIN 8	D
PIN 2	F	PIN 9	COMMON
PIN 3	COMMON	PIN 10	C
PIN 4	NC	PIN 11	G
PIN 5	NC	PIN 12	NC
PIN 6	DECIMAL POINT	PIN 13	B
PIN 7	E	PIN 14	COMMON

JUMPER PINS 3, 9 and 14 ON CIRCUIT BOARD

MDA100 Functional Diagram

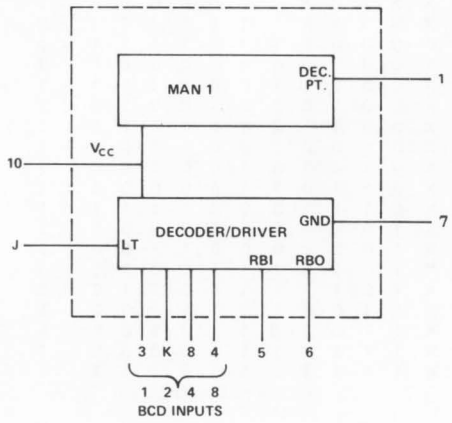


MDA101 Package Dimensions

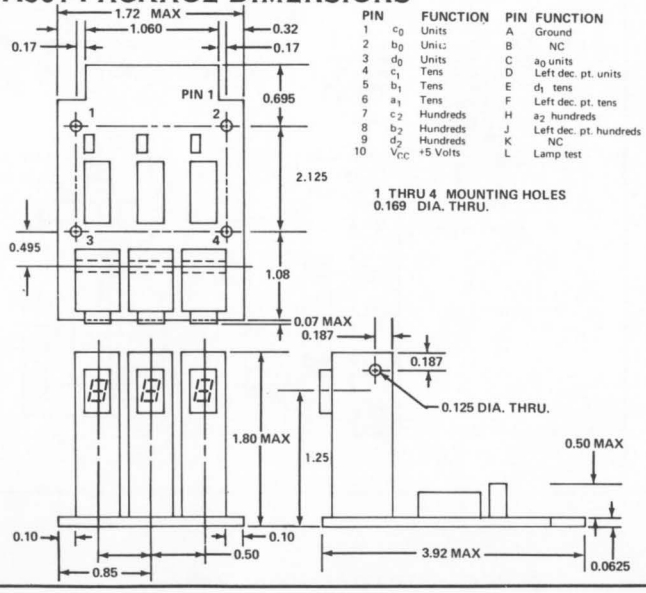


PIN	FUNCTION	PIN	FUNCTION
1	Dec. pt.	A	NC
2	NC	B	NC
3	BCD input "1"	C	NC
4	BCD input "8"	D	NC
5	RBI	E	NC
6	RBO	F	NC
7	Ground	H	Ground
8	BCD input "4"	J	Lamp test
9	NC	K	BCD input "2"
10	V_{CC} +5 volts	L	NC

MDA101 Schematic Diagram



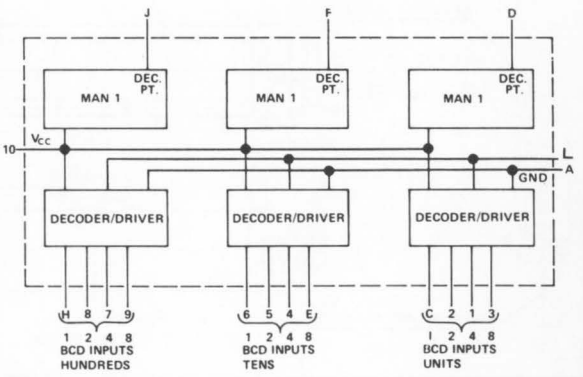
MDA301 Package Dimensions



PIN		FUNCTION	PIN	FUNCTION
1	c_0	Units	A	Ground
2	b_0	Units	B	NC
3	d_0	Units	C	a_0 units
4	c_1	Tens	D	Left dec. pt. units
5	b_1	Tens	E	d_1 tens
6	a_1	Tens	F	Left dec. pt. tens
7	c_2	Hundreds	H	a_2 hundreds
8	b_2	Hundreds	J	Left dec. pt. hundreds
9	d_2	Hundreds	K	NC
10	V_{CC}	+5 Volts	L	Lamp test

1 THRU 4 MOUNTING HOLES
0.169 DIA. THRU.

MDA301 Schematic Diagram



MDA100 MDA101 MDA301

TYPICAL CURVES

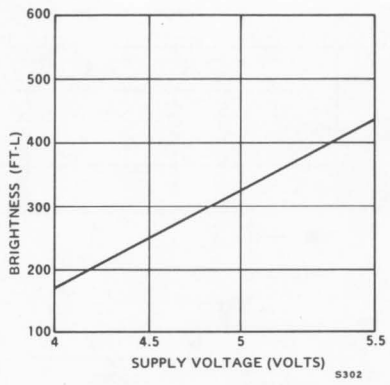


Figure 1 Brightness vs. Supply Voltage

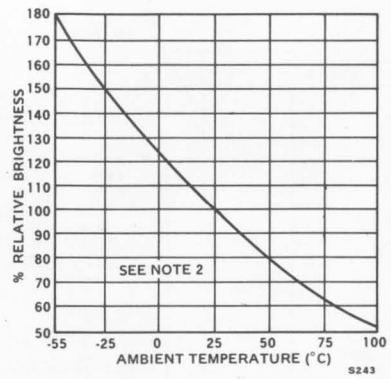


Figure 2 Brightness vs. Temperature

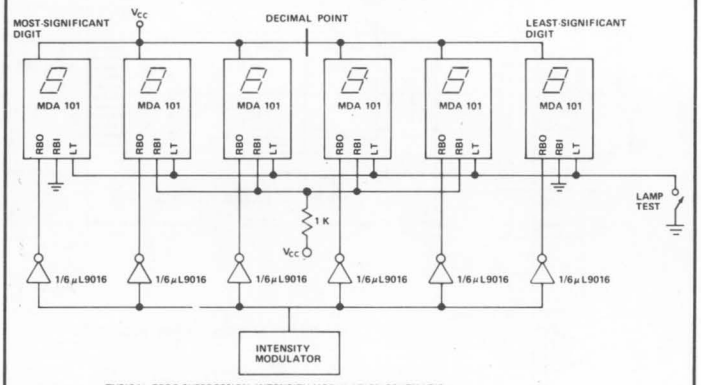
TRUTH TABLE

MSD 047

LT	RBI	d	c	b	a	A'	B'	C'	D'	E'	F'	G'	BI/RBO	DISPLAY
0	X	X	X	X	X	0	0	0	0	0	0	0	1	8
X	X	X	X	X	X	1	1	1	1	1	1	1	0	Blank
1	0	0	0	0	0	1	1	1	1	1	1	1	0	Blank
1	1	0	0	0	0	0	0	0	0	0	0	1	1	0
1	X	0	0	0	1	1	0	0	1	1	1	1	1	1
1	X	0	0	1	0	0	0	1	0	0	1	0	1	2
1	X	0	0	1	1	0	0	0	0	1	1	0	1	3
1	X	0	1	0	0	1	0	0	1	1	0	0	1	4
1	X	0	1	0	1	0	1	0	0	1	0	0	1	5
1	X	0	1	1	0	1	1	0	0	0	0	0	1	6
1	X	0	1	1	1	0	0	0	1	1	1	1	1	7
1	X	1	0	0	0	0	0	0	0	0	0	0	1	8
1	X	1	0	0	1	0	0	0	1	1	0	0	1	9
1	X	1	0	1	0	1	1	1	0	0	1	0	1	A
1	X	1	0	1	1	1	1	0	0	1	1	0	1	b
1	X	1	1	0	0	1	1	1	1	1	0	0	1	C
1	X	1	1	0	1	0	1	1	0	1	0	0	1	d
1	X	1	1	1	0	1	1	1	0	0	0	0	1	E
1	X	1	1	1	1	1	1	1	1	1	1	1	1	Blank

X = DON'T CARE CONDITION

SCHEMATIC



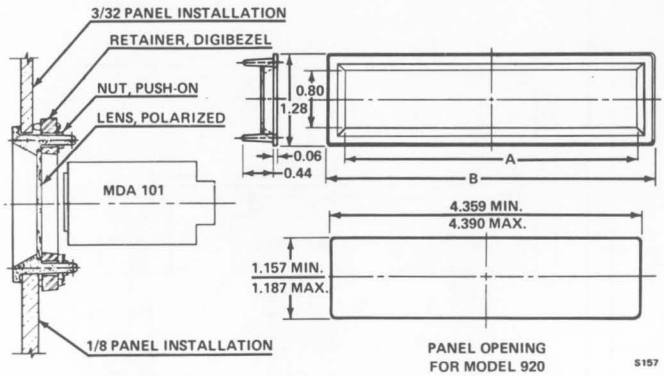
TYPICAL ZERO SUPPRESSION, INTENSITY MODULATION SCHEMATIC

THIS SCHEMATIC ILLUSTRATES A TYPICAL ZERO SUPPRESSION AND INTENSITY MODULATION APPLICATION OF THE MDA 101. THE BCD INPUTS HAVE NOT BEEN SHOWN IN ORDER TO SIMPLIFY THE ILLUSTRATION

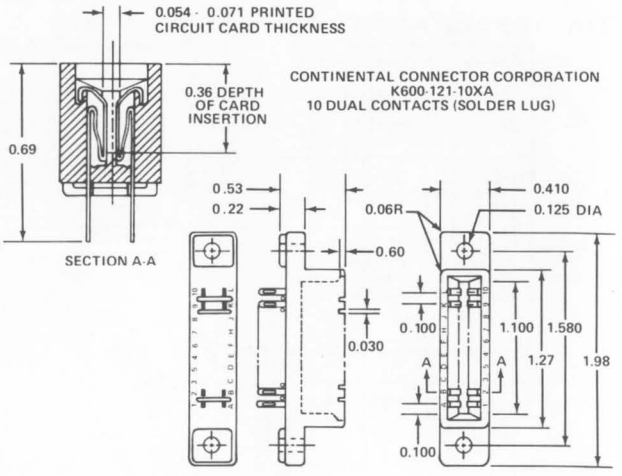
RECOMMENDED BEZEL & MOUNTING

NOBEX DIVISION/GRIFFITH PLASTICS CORPORATION

MODEL	DESCRIPTION	DIMENSIONS A	B
920	7-8 MDA 100 OR MDA 101	4.00"	4.48"
940	10-11 MDA 100 OR MDA 101	5.58"	6.06"



RECOMMENDED CONNECTOR

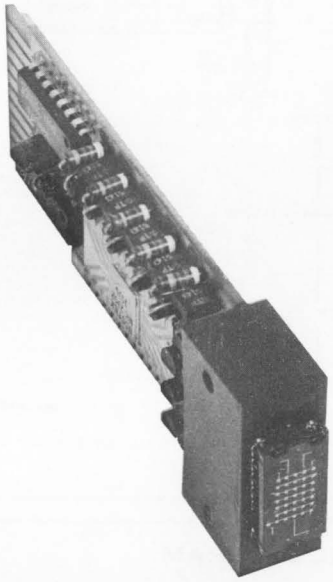


Monsanto ALPHA-NUMERIC DISPLAY ASSEMBLY | MDAIII

PRODUCT DESCRIPTION

The MDA 111 is a 5 x 7 dot matrix alpha-numeric display module which contains its own character generator capable of displaying 64 ASCII characters. Character selection is achieved by presenting a six-bit binary word at the module input. The display is a 5 x 7 array of light emitting diodes having a character height of 0.350 inches.

MDA111 DISPLAY ASSEMBLY



FEATURES & APPLICATIONS

Reliable LED single plane display
Self-contained character generator, including clock
Six-line TTL/DTL compatible inputs
Sixty-four ASCII encoded characters
Low voltage system - +5 volts and -12 volts
Convenient blanking capability
Easy to mount modular design

♦

Computer terminal readout
Avionic display
Keyboard verifier
Portable instrument display
Mobile equipment readout
Film annotation system

ABSOLUTE MAXIMUM RATINGS

Storage Temperature	-55°C to 100°C
Operating Temperature	0°C to 70°C
Voltage on V_{GG} terminal (see note 3)	+5.3 volts to -15.0 volts
Voltage on V_{CC} terminal (see note 3)	0 volts to 5.3 volts

RECOMMENDED OPERATING CONDITIONS

(T_A = 0°C to 70°C)

	MINIMUM	MAXIMUM	UNITS
V_{CC} supply voltage (see note 3)	+ 4.75	+ 5.25	volts
V_{GG} supply voltage (see note 3)	– 12.60	– 11.40	volts
V_{IL} input voltage required to ensure logic 0		+ 0.60	volts
V_{IH} input voltage required to ensure logic 1	+ 3.50		volts

ELECTRICAL CHARACTERISTICS

(V_{CC} = +5.0 volts ± 0.25 volts, V_{GG} = -12.0 volts ± 0.6 volts, T_A = 0°C to 70°C)

	TYPICAL	MAXIMUM	UNITS
I_{CC} supply current	200	250	mA
I_{GG} supply current	30	40	mA
I_{IN} input current @ any logic level		10	μA

MDAIII

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS

(V_{CC} = +5.0 volts ±0.25 volts, V_{GG} = -12.0 volts ±0.6 volts, T_A = 25°C)

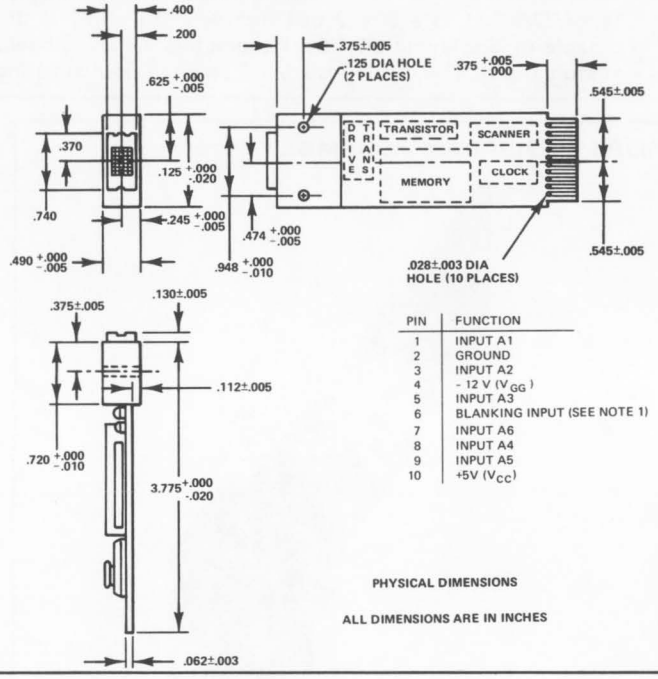
Brightness, each diode	300 ft-L
Peak emission wavelength	6500Å
Spectral line half width	.400Å

TRUTH TABLE

TRUTH TABLE				A_5 / A_6	1_0	1_1	0_0	0_1
A_4	A_3	A_2	A_1	COL / ROW	2	3	4	5
0	0	0	0	0				
0	0	0	1	1				
0	0	1	0	2				
0	0	1	1	3				
0	1	0	0	4				
0	1	0	1	5				
0	1	1	0	6				
0	1	1	1	7				
1	0	0	0	8				
1	0	0	1	9				
1	0	1	0	10				
1	0	1	1	11				
1	1	0	0	12				
1	1	0	1	13				
1	1	1	0	14				
1	1	1	1	15				

When grounded, "Blanking" takes priority over any character mode.

PACKAGE DIMENSIONS

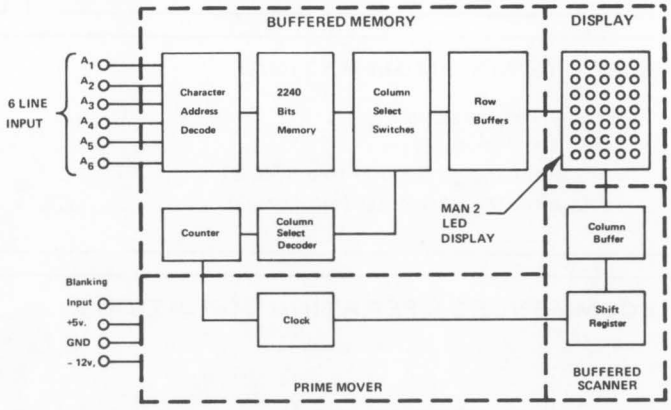


PIN	FUNCTION
1	INPUT A1
2	GROUND
3	INPUT A2
4	- 12 V (V_{GG})
5	INPUT A3
6	BLANKING INPUT (SEE NOTE 1)
7	INPUT A6
8	INPUT A4
9	INPUT A5
10	+5V (V_{CC})

PHYSICAL DIMENSIONS

ALL DIMENSIONS ARE IN INCHES

FUNCTIONAL DIAGRAM



NOTES

1. *If not used, blanking input must be connected to +5.0 volts.*
2. *Recommended connectors = Viking No. 2VH10/1JN-5, Cinch No. 251-10-30-410, Continental No. K600-1Z1-10XA.*
3. *Ratings and conditions for Pin No. 2 = GND. Supply voltages shown are for TTL/DTL operation.*

Monsanto

BCD DECADE COUNTER

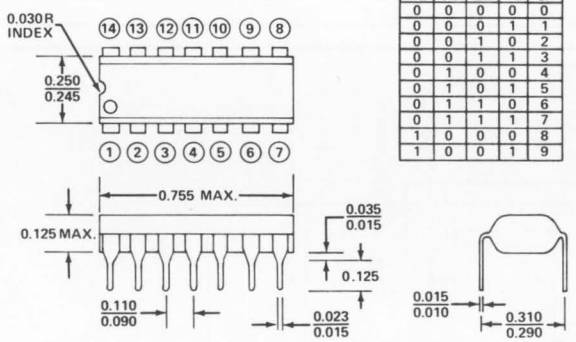
MDK100

PRODUCT DESCRIPTION

The MDK100 is a monolithic decade counter consisting of four internally interconnected flip-flops providing a wide variety of counter applications.

This device is recommended for use as the counter/storage element for digital display systems such as those using Monsanto's MAN1 and MAN3 seven segment LED displays. The MDK100 is completely compatible with the MQL105 quadruple latch and the MSD047 or MSD101 decoder/driver.

PACKAGE DIMENSIONS



8	4	2	1	OUTPUT ON
4Q	3Q	2Q	1Q	
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9

FEATURES

- Device has both serial and strobed parallel-entry capability
- The MDK100 can be connected in the BCD counting mode
  divide-by-two
  divide-by-five
- Completely compatible with all popular TTL or DTL families
- 14 pin dual-in-line package

ABSOLUTE MAXIMUM RATINGS

Maximum Storage Temperature	-55°C to 135°C
Maximum Operating Temperature	0°C to 70°C
Maximum Supply Voltage V_{CC} (see note 1)	7.0 volts
Input Voltage (see note 1 and 2)	5.5 volts
Current into any input	±1.0 mA

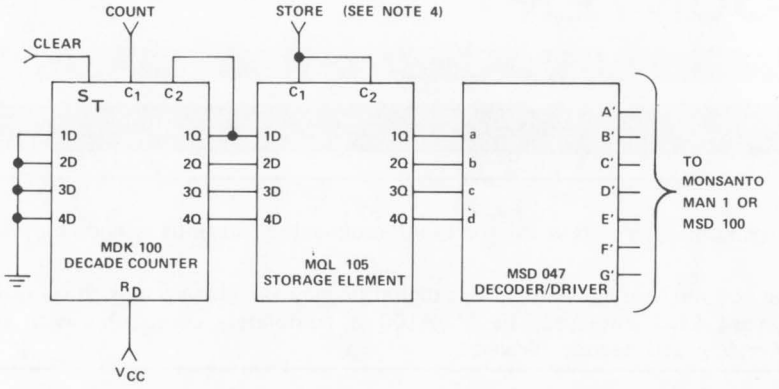
ELECTRICAL CHARACTERISTICS

(T_A = 0°C to 70°C, V_{CC} = 5.0 ±5% volts)

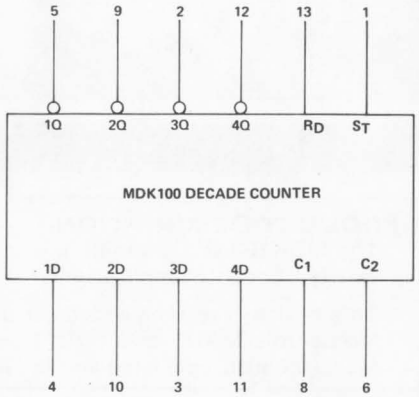
SYMBOLS	CHARACTERISTICS	MIN	TYP	MAX	UNIT	TEST CONDITIONS
V_{IL}	Input voltage required to ensure logic 0			0.8	V	V_{CC}=4.75 V
V_{IH}	Input voltage required to ensure logic 1	2.6			V	V_{CC}=4.75 V
V_{OL}	Logical 0 output voltage			0.5	V	V_{CC}=4.75 V, I_{OL}=4.8 mA
V_{OH}	Logical 1 output voltage	2.6			V	V_{CC}=4.75 V, I_{OL}=200 μA
I_{IL}	Logical 0 level input current					V_{CC}=5.25 V
		-0.1		-1.6	mA	data/strobe=0.4 V
		-0.1		-1.2	mA	data input=0.4 V
		-0.1		-5.0	mA	reset=0.4 V
		-0.1		-3.2	mA	clock 1=0.4 V
		-0.1		-3.2	mA	clock 2=0.4 V
I_{IH}	Logical 1 level input current					V_{CC}=5.0 V
				25	μA	data/strobe=2.6 V
				25	μA	data/input=2.6 V
				100	μA	reset=2.6 V
				75	μA	clock 1=2.6 V
				100	μA	clock 2=2.6 V
I_{OS}	Short-circuit output current(note 3)		-10		mA	V_{CC}=5.0 V, V_{OUT}=0
I_{CC}	Supply current			37	mA	V_{CC}=5.25 V, All outputs open

MDK100

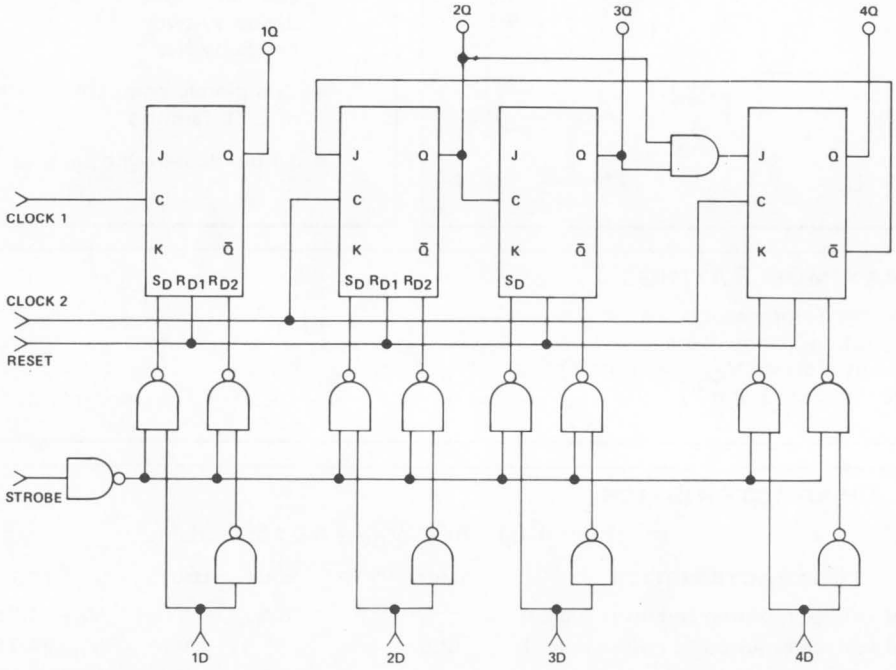
Individual Address For MAN1



Logic Symbol



Functional Block Diagram



Notes

1. *These voltage values are with respect to network ground terminal.*
2. *Input signals must be zero or positive with respect to network ground terminal.*
3. *Not more than one output should be shorted at a time.*
4. *Information present at a data (D) input is transferred to the Q output when the clock is high, and the Q output will follow the data input as long as the clock remains high. When the clock goes low, the information [at (D) input] is retained at the Q output until the clock is permitted to go high.*

Monsanto

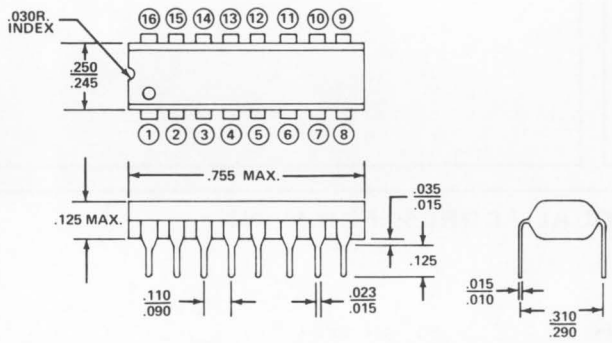
FOUR-BIT BISTABLE LATCH | MQL105

PRODUCT DESCRIPTION

The MQL105 is a monolithic quadruple bistable latch to be used as temporary storage for binary-coded decimal data between processing units and input/output or indicator units.

This device is recommended for use as the temporary storage for BCD data, from the MDK100 decade counter, which is to be decoded by the MSD047 or MSD101 decoder/driver.

PACKAGE DIMENSIONS



FEATURES

- Complementary outputs, both Q and $\overline{Q}$
- MQL105 is completely compatible with all popular TTL or DTL families
- Ideally suited for use as storage element for binary information
- 16 pin dual-in-line package

ABSOLUTE MAXIMUM RATINGS

Maximum Storage Temperature	-55°C to 135°C
Maximum Operating Temperature	0°C to 70°C
Maximum Supply Voltage V_{CC} (see note 1)	6.0 volts
Input Voltage (see note 1 & 2)	6.0 volts
Current into any Input	±1.0 mA

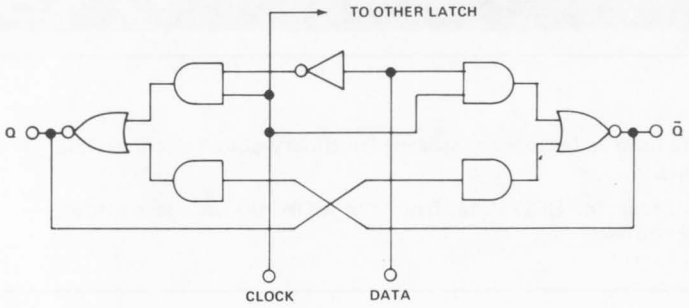
ELECTRICAL CHARACTERISTICS

(T_A = 0°C to 70°C, V_{CC} = 5.0 ±5% volts)

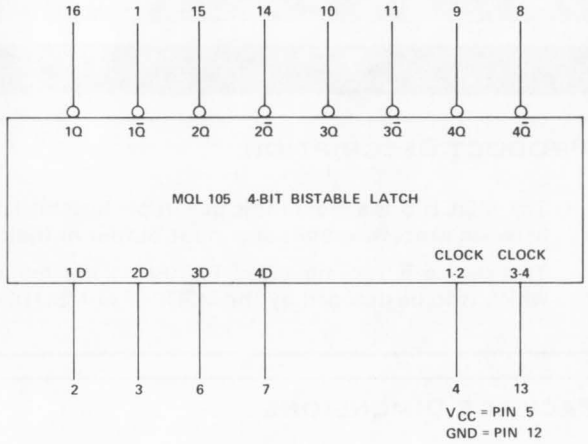
SYMBOL	CHARACTERISTICS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{IL}	Input voltage required to ensure logic 0			0.8	V	V_{CC}=4.75 V
V_{IH}	Input voltage required to ensure logic 1	2.0			V	V_{CC}=4.75 V
V_{OL}	Logical 0 output voltage			0.4	V	V_{CC}=4.75 V, I_{OL}=12 mA
V_{OH}	Logical 1 output voltage	2.6			V	V_{CC}=4.75 V, I_{OH}=400 μA
I_{IL}	Logical 0 level input current at D			-3.2	mA	V_{CC}=5.25 V, V_{IN}=0.4 V
$I_{IL(C)}$	Logical 0 level input current at clock			-6.4	mA	V_{CC}=5.25 V, V_{IN}=0.4 V
I_{IH}	Logical 1 level input current at D			50	μA	V_{CC}=5.25 V, V_{IN}=2.4 V
$I_{IH(C)}$	Logical 1 level input current at clock			100	μA	V_{CC}=5.25 V, V_{IN}=2.4 V
I_{OS}	Short circuit output current (note 3)	-18		-75	mA	V_{CC}=5.25 V, V_{OUT}=0
I_{CC}	Supply Current		35		mA	V_{CC}=5.25 V, All outputs open

MQL105

Functional Block Diagram



Logic Symbol



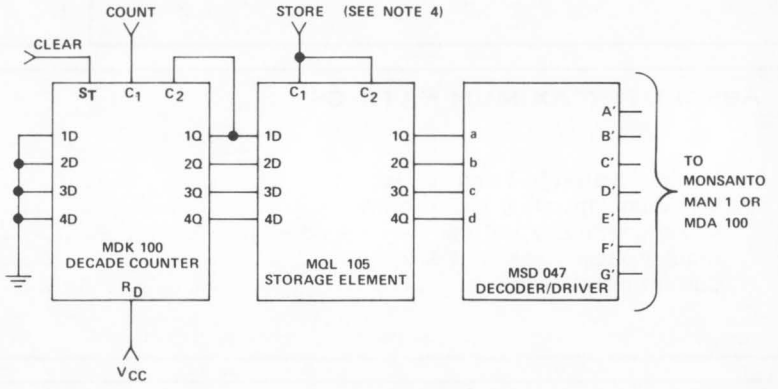
Truth Table (Each Latch)

t_n	t_{n+1}	t_{n+1}
D	Q	$\bar{Q}$
1	1	0
0	0	1

t_n = BIT TIME BEFORE CLOCK PULSE TRANSITION

t_{n+1} = BIT TIME AFTER CLOCK PULSE TRANSITION

Individual Address For MAN1



Notes

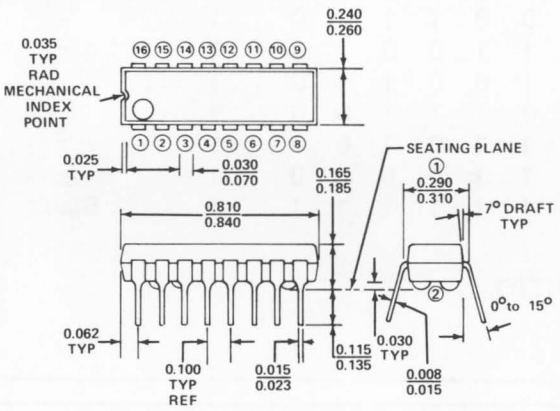
1. *These voltage values are with respect to network ground terminal.*
2. *Input signals must be zero or positive with respect to network ground terminal.*
3. *Not more than one output should be shorted at a time.*
4. *Information present at a data (D) input is transferred to the Q output when the clock is high, and the Q output will follow the data input as long as the clock remains high. When the clock goes low, the information [at (D) input] is retained at the Q output until the clock is permitted to go high.*

Monsanto SEVEN SEGMENT DECODER DRIVER | MSD047

PRODUCT DESCRIPTION

The MSD 047 is a monolithic BCD to seven segment active low decoder/driver providing high-sink current outputs for driving indicators directly.

PACKAGE DIMENSIONS



① This dimension is measured at the seating plane.
② 4 insulating stand-offs are provided.

FEATURES

- Automatic blanking of leading and/or trailing edge zeros
- Lamp Test
- Intensity Control
- BCD inputs are compatible with DTL and TTL devices
- Sink current per output - 20 mA
- 16 PIN dual in line package

This device is recommended for use as the four line BCD decoder and driver for Monsanto's MAN 1 seven segment LED display. The MSD 047 is completely compatible with the MDK 100 decade counter and the MQL 105 quadruple latch.

ABSOLUTE MAXIMUM RATINGS

Maximum Storage Temperature	-55°C to 135°C
Maximum Operating Temperature	0°C to 70°C
Maximum Supply Voltage V_{CC} (See Note 1	7.0 volts
Input Voltage (See Note 1 and 2)	5.5 volts
Current into any Input	20 mA
Current into any output (See note 3)	1.0 mA

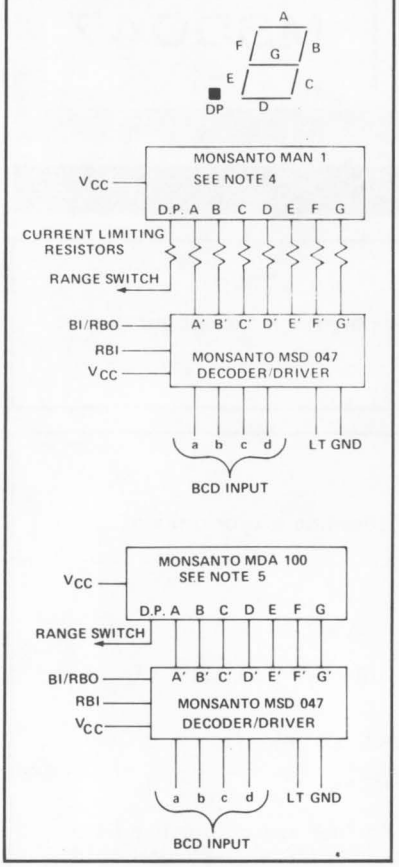
ELECTRICAL CHARACTERISTICS

(T_A = 0°C to 70°C, V_{CC} = 5.0 ±5% volts)

SYMBOL	CHARACTERISTICS	MIN	TYP	MAX	UNITS	TEST CONDITIONS
V_{IL}	Input voltage required to ensure logic 0			0.8	V	V_{CC}=4.75 V
V_{IH}	Input voltage required to ensure logic 1	2.0			V	V_{CC}=4.75 V
V_{OL}	On-state output voltage (a thru g)		0.27	0.4	V	V_{CC}=4.75 V, I_{OL}=20 mA
$V_{OL(RBO)}$	Logical 0 output voltage at B1/RBO Node		0.30	0.4	V	V_{CC}=4.75 V, I_{OL}=8 mA
V_{OH}	Logical 1 output voltage at B1/RBO Node	2.4	3.70		V	V_{CC}=4.75 V, I_{LOAD}=-20 μA
V_{OFF}	Off-state output voltage at a thru g	15			V	V_{CC}=5.25 V, I_{OFF}=250 μA
I_{IL}	Logical 0 level input; current at any input except B1/RBO Node			-1.6	mA	V_{CC}=5.25 V, V_{IN}=0.4 V
$I_{IL(RBO)}$	Logical 0 level input current at B1/RBO Node			-4.2	mA	V_{CC}=5.25 V, V_{IN}=0.4 V
I_{IH}	Logical 1 level input current at any input except B1/RBO Node			1	mA	V_{CC}=5.25 V, V_{IN}=5.5 V
I_{OL}	Output sink current			20	mA	V_{CC}=4.75 V
I_{OS}	Short circuit output current at B1/RBO Node			-4	mA	V_{CC}=5.25 V All inputs open
I_{CC}	Supply current		25	55	mA	V_{CC}=5.25 V All outputs open

MSD047

FUNCTIONAL DIAGRAM

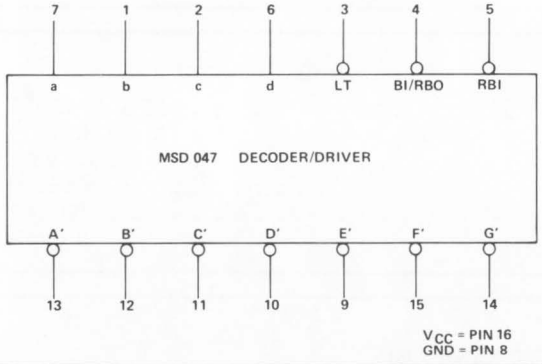


TRUTH TABLE

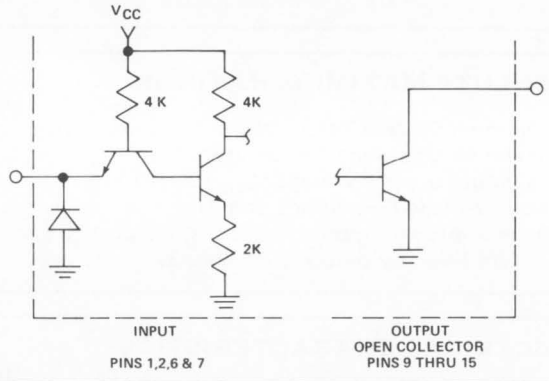
LT	RBI	d	c	b	a	A'	B'	C'	D'	E'	F'	G'	BI/RBO	DISPLAY
0	X	X	X	X	X	0	0	0	0	0	0	0	1 NOTE 6	8
X	X	X	X	X	X	1	1	1	1	1	1	1	0 NOTE 7	Blank
1	0	0	0	0	0	1	1	1	1	1	1	1	1 NOTE 8	Blank
1	1	0	0	0	0	0	0	0	0	0	0	1	1	0
1	X	0	0	0	1	1	0	0	1	1	1	1	1	1
1	X	0	0	1	0	0	0	1	0	0	1	0	1	2
1	X	0	0	1	1	0	0	0	0	1	1	0	1	3
1	X	0	1	0	0	1	0	0	1	1	0	0	1	4
1	X	0	1	0	1	0	1	0	0	1	0	0	1	5
1	X	0	1	1	0	1	1	0	0	0	0	0	1	6
1	X	0	1	1	1	0	0	0	1	1	1	1	1	7
1	X	1	0	0	0	0	0	0	0	0	0	0	1	8
1	X	1	0	0	1	0	0	0	1	1	0	0	1	9
1	X	1	0	1	0	1	1	1	0	0	1	0	1	c
1	X	1	0	1	1	1	1	0	0	1	1	0	1	J
1	X	1	1	0	0	1	0	1	1	1	0	0	1	L
1	X	1	1	0	1	0	1	1	0	1	0	0	1	E
1	X	1	1	1	0	1	1	1	0	0	0	0	1	F
1	X	1	1	1	1	1	1	1	1	1	1	1	1	Blank

X = DON'T CARE CONDITIONS

LOGIC SYMBOL



INPUT/OUTPUT CIRCUITS



NOTES

1. *These voltage values are with respect to network ground terminal.*
2. *Input voltage must be zero or positive with respect to network ground terminal.*
3. *This rating applies when the output is off.*
4. *Refer to Product Data Sheet for more detailed information on the Monsanto MAN1 Alpha-Numeric Display.*
5. *The MDA100 is a compact module display that features built-in resistors. See the product data sheet for more detailed information.*
6. *When blanking input/ripple-blanking output is open or held at a logic "1", and a logic "0" is applied to lamp-test input, all segment outputs go to a logic "0".*
7. *When a logic "0" is applied to the blanking input (forced condition) all segment outputs go to a logic "1" regardless of the state of any other input condition.*
8. *When ripple-blanking input (RB1) is at a logic "0" and A=B=C=D=logic "0", all segment outputs go to a logic "1" and the ripple-blanking output goes to a logic "0" (response condition).*

Monsanto

SEVEN SEGMENT DECODER DRIVERS

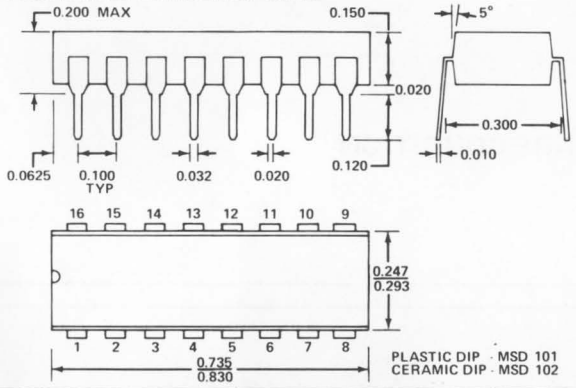
MSD101 MSD102

PRODUCT DESCRIPTION

The MSD 101 is a monolithic BCD to seven segment active high decoder/driver providing current outputs for driving indicators directly. The MSD101 is designed to provide source currents of 5.0 mA for an output of 1.7 volts. This device is recommended for use as the four line BCD decoder and driver for the Monsanto MAN3 seven-segment LED display. The MSD101 features built-in resistors and is compatible with the MDK100 decade counter and the MQL105 quadruple latch.

The MSD102 is a monolithic BCD to seven segment active high decoder/driver providing high current outputs for driving indicators directly. The MSD102 is designed to provide source currents of 50 mA for an output of 2.3 volts. This device is recommended for use as the four line BCD decoder and driver for the Monsanto MAN3 in multiplexing applications. The MSD102 features built-in resistors and is compatible with the MDK100 decade counter and the MQL105 quadruple latch.

PACKAGE DIMENSIONS



FEATURES

- Designed specifically to drive the MAN3
- All circuit interfacing components included in the IC-resistors built in
- BCD inputs are compatible with DTL and TTL devices
- Intensity control
- Automatic blanking of leading AND/OR trailing edge zeroes
- Lamp Test

ABSOLUTE MAXIMUM RATINGS

Maximum storage temperature	-66°C to 150°C
Maximum operating temperature	0°C to 85°C
Maximum supply voltage V_{CC} (see note 1)	7.0 volts
Input voltage (see note 1 and 2)	5.5 volts
Current into any input	20 mA
Current into any output	10 mA

ELECTRICAL CHARACTERISTICS

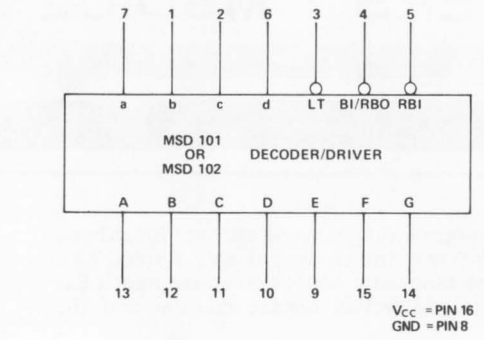
(T_A = 0°C to 85°C, V_{CC} = 5.0 ±5% volts)

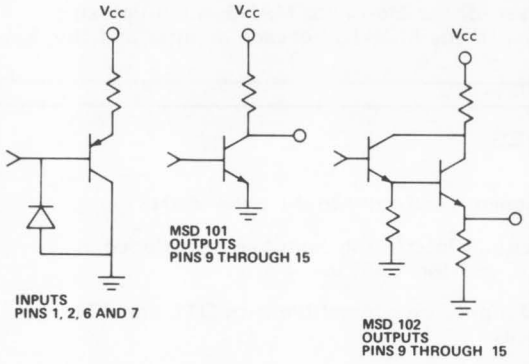
SYMBOL	CHARACTERISTICS	MIN	MAX	UNIT	TEST CONDITIONS
V_{IL}	Input voltage required to ensure logic 0		0.85	V	V_{CC}=4.75 V
V_{IH}	Input voltage required to ensure logic 1	2.0		V	V_{CC}=4.75 V
I_{IL}	Logical 0 level input current except lamp test		-125	μA	V_{CC}=5.25 V, V_{IN}=0.45 V, V_{LT}=2.5 V
$I_{IL(LT)}$	Logical 0 level input current for lamp test		-500	μA	V_{CC}=5.25 V, V_{IN}=0.45 V
I_{IH}	Logical 1 level input current except lamp test		40	μA	V_{CC}=5.25 V, V_{IN}=5.25 V
$I_{IH(LT)}$	Logical 1 level input current for lamp test		160	A	V_{CC}=5.25 V, V_{IN}=5.25 V
V_C	Input clamp voltage		-1.0	V	V_{CC}=4.75 V, I_C=5.0 mA
I_{OH}	Output source current (MSD101)	-5.0	-7.5	mA	V_{CC}=5.0 V, V_{OUT}=1.7 V, V_{LT}=0.45 V
	Output source current (85°C) (MSD101)	-4.7	-7.2	mA	V_{CC}=5.0 V, V_{OUT}=1.7 V, V_{LT}=0.45 V
* I_{OH}	Output source current (MSD102)	-40	-60	mA	V_{CC}=5.0 V, V_{OUT}= 2.3V, V_{LT}=0.45 V
$V_{OL(RBO)}$	Logical 0 output voltage at RBO		0.45	V	V_{CC}=4.75 V, I_{RBO}=6 mA
I_{CC}	Supply current		60	mA	V_{CC}=5.25 V, All outputs high

* Outputs A through G of the MSD 102 should never be short circuited while under operation. An equivalent load resistance of ⩾ 50 Ω is required to prevent excessive source current to flow.

MSD101 MSD102

Logic Symbol & Input/Output Circuits



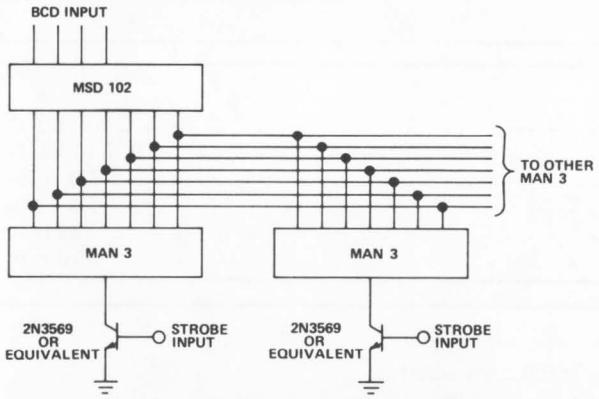


Truth Table

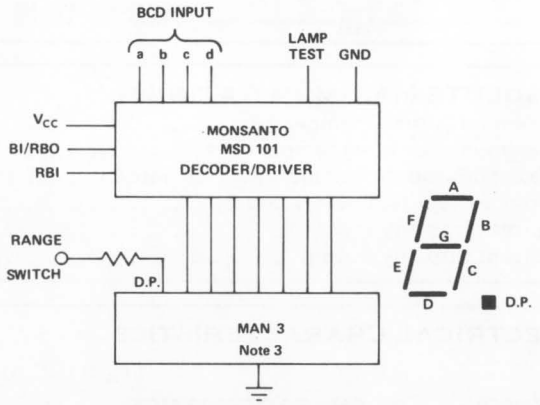
LT	RBI	d	c	b	a	A	B	C	D	E	F	G	BI/RBO	Display
0	X	X	X	X	X	1	1	1	1	1	1	1	1 Note 4	8
X	X	X	X	X	X	0	0	0	0	0	0	0	0 Note 5	Blank
1	0	0	0	0	0	0	0	0	0	0	0	0	0 Note 6	Blank
1	1	0	0	0	0	1	1	1	1	1	1	0	1	0
1	X	0	0	0	1	0	1	1	0	0	0	0	1	1
1	X	0	0	1	0	1	1	0	1	1	0	1	1	2
1	X	0	0	1	1	1	1	1	1	0	0	1	1	3
1	X	0	1	0	0	0	1	1	0	0	1	1	1	4
1	X	0	1	0	1	1	0	1	1	0	1	1	1	5
1	X	0	1	1	0	1	0	1	1	1	1	1	1	6
1	X	0	1	1	1	1	1	1	0	0	0	0	1	7
1	X	1	0	0	0	1	1	1	1	1	1	1	1	8
1	X	1	0	0	1	1	1	1	1	0	1	1	1	9
1	X	1	0	1	0	0	0	0	0	0	0	1	1	-
1	X	1	0	1	1	0	0	0	0	0	0	0	1	Blank
1	X	1	1	0	0	0	1	1	0	1	1	1	1	-
1	X	1	1	0	1	0	0	0	1	1	1	0	1	-
1	X	1	1	1	0	1	1	0	0	1	1	1	1	-
1	X	1	1	1	1	0	0	0	0	0	0	0	1	Blank

X = DON'T CARE CONDITION

Functional Diagrams



Typical Multiplexing Schematic for 16 Digit Display



Decoder/Driver Diagram

Notes

1. *These voltage values are with respect to network ground terminal.*
2. *Input voltage must be zero or positive with respect to network ground terminal.*
3. *Refer to product data sheet for more detailed information on the Monsanto MAN 3 Alpha-Numeric Display.*
4. *When blanking input/ripple-blanking output is open or held at a logic "1", and a logic "0" is applied to lamp-test input, all segment outputs go to a logic "0".*
5. *When a logic "0" is applied to the blanking input (forced condition) all segment outputs go to a logic "1" regardless of the state of any other input condition.*
6. *When ripple-blanking input (RB1) is at a logic "0" and A=B=C=D=logic "0", all segment outputs go to a logic "1" and the ripple-blanking output goes to a logic "0" (response condition).*

Monsanto

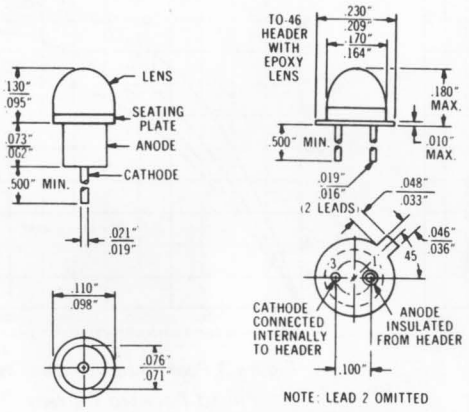
INFRARED EMITTERS

ME3 ME1 ME4 MI20C

PRODUCT DESCRIPTION

These infrared diodes are diffused planar Gallium Arsenide. The ME 1 & 3 are mounted in .10" coaxial packages. The ME 4 & MI20C are mounted in TO-18 headers. All four types have clear epoxy lenses.

PACKAGE DIMENSIONS



ME1
ME3

ME4
MI20C

FEATURES

- High Output Power--1.5mW min. @ 100 mA with Low Power Requirements--0.15 watts (maximum).
- Fast Switching Time--Typically 1.0 nsec
- Long Life--Solid State Reliability
- Small, Rugged, Lightweight
- IR Source for Silicon and Cadmium Sensors

ABSOLUTE MAXIMUM RATINGS

	ME3 ME1	ME4 MI20C
Maximum Power Dissipation @25°C Ambient Temperature	130mW	250mW
Derate Linearly from 25°C	1.73mW/°C	3.33mW/°C
Maximum Storage and Operating Temperature	-55°C to 100°C	-55°C to 100°C
Maximum Lead Solder Time @260°C	7.0 s	7.0 s
Maximum Currents and Voltages		
Continuous Forward Current	100mA	150mA
Peak Forward Current (1μs pulse, 300 pps)	0.5A	3.0A
Reverse Voltage	3.0V	3.0V

ELECTRO-OPTICAL CHARACTERISTICS

(25° C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Total external radiated power (see note 2)					
ME3	0.5	0.8		mW	I_F=50 mA
ME1	1.0	1.5		mW	I_F=50 mA
ME4	0.5	1.0		mW	I_F=100 mA
MI20C	1.5	2.0		mW	I_F=100 mA
Peak emission wave length		9000		Å	
Spectral line half width		400		Å	
Forward voltage					
ME3, ME1		1.3	1.5	V	I_F=50 mA
ME4, MI20C		1.3	1.5	V	I_F=100 mA
Forward dynamic resistance					
ME3, ME1		2.5		Ω	I_F=50 mA
ME4, MI20C		1.2		Ω	I_F=50 mA
Reverse current		.15	10	μA	V_R=3.0 V
Capacitance					
ME3, ME1		100		pF	V=0
ME4, MI20C		150		pF	V=0
Light turn on and turn off		1.0		ns	

ME3 ME4 MEI MI20C

TYPICAL THERMAL CHARACTERISTICS

	ME3 ME1	ME4 MI20C
Thermal Resistance Junction to Free Air Θ_{JA}	330°C/W	250°C/W
Thermal Resistance Junction to Case Θ_{JC}	175°C/W	75°C/W
Wavelength Temperature Coefficient (case temp)	2.8 Å/°C	2.8 Å/°C
Forward Voltage Temperature Coefficient	-1.8mV/°C	-1.8mV/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

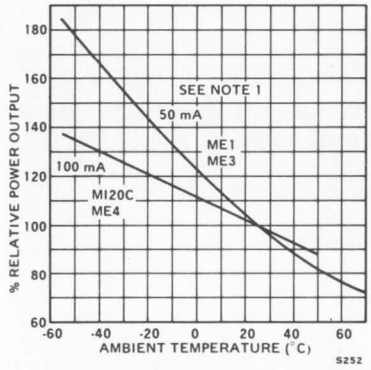


Figure 1 Power Output vs. Temperature Free Standing Diode

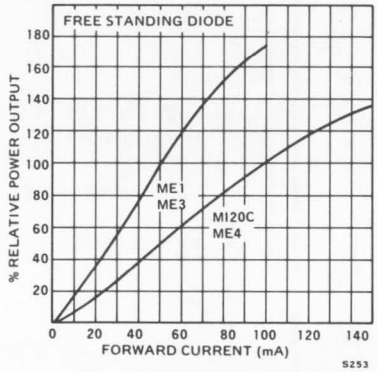


Figure 2 % Relative Power Output vs. Forward Current

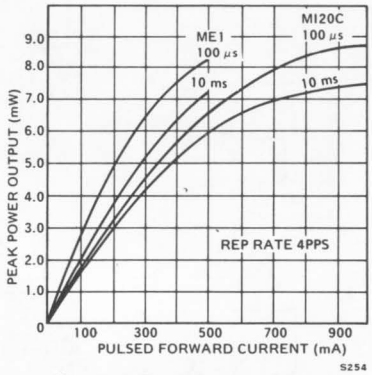


Figure 3 Peak Output Power vs. Pulsed Forward Current

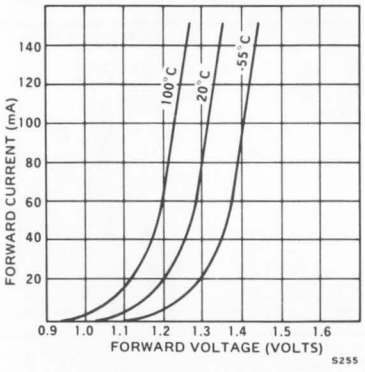


Figure 4 Forward Current vs. Forward Voltage

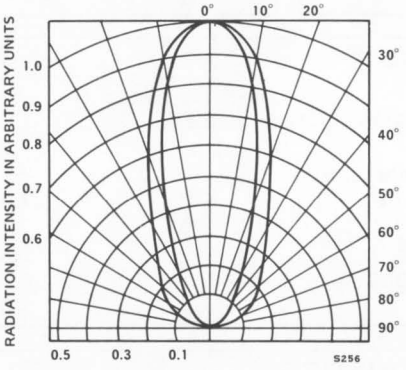


Figure 5 Spacial Distribution

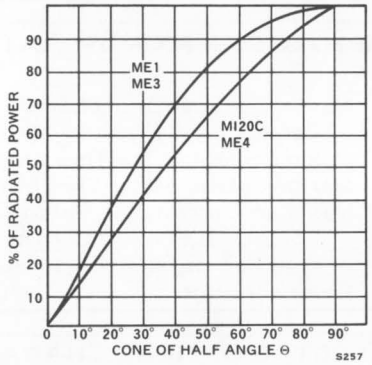


Figure 6 % Of Radiated Power Into Cone Of Half Angle

NOTES

1. *The curves in figure 1 are normalized to the power output at 25°C to indicate the relative efficiency over the operating temperature range.*
2. *The total external radiated power output measurements are made with a Centralab 110C solar cell terminated into a 100Ω impedance.*
3. *The leads of the ME4 and MI20C were immersed in molten solder, heated to 260°C, to a point 1/16 inch from the body of the device, per MIL-S-750. Suggested mounting procedures for ME1 and ME3: (a) Use wet sponge to heat sink lens when soldering (b) Use conductive epoxy (c) Press fit.*

Monsanto

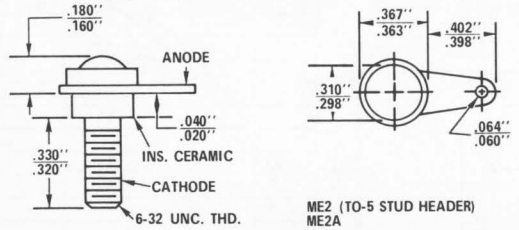
HIGH POWER INFRARED EMITTERS

ME2 ME5 ME2A ME5A

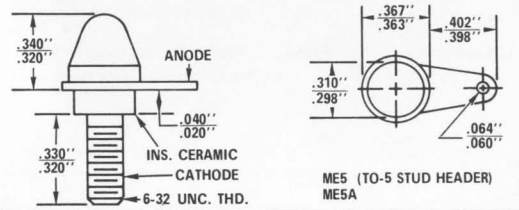
PRODUCT DESCRIPTION

The ME2 and 2A are diffused planar gallium arsenide diodes mounted on a TO-5 stud header with a low , dispersive epoxy lens. The ME5 and 5A are identical diodes in the same mount, but with a high collimating lens.

PACKAGE DIMENSIONS



ME2 (TO-5 STUD HEADER)
ME2A



ME5 (TO-5 STUD HEADER)
ME5A

FEATURES & APPLICATIONS

- Top value in mW/$
- Ultra high output power
- Fast switching time
- Choice of lambertian or collimated radiation pattern
- Long life--solid state reliability
- Rugged, compact and lightweight

♦

The ME2 and ME5 series are large area illuminator sources of IR for industrial and military applications such as:

- Card or tape readers
- Silicon detector companion source
- Intrusion alarm
- Electrical isolator
- Optical shaft encoder
- Optical counters and sorters
- A G C

ABSOLUTE MAXIMUM RATINGS

Power dissipation @25°C case temperature	.3 W
Derate linearly from 25°C	40 mW/°C
Storage and operating temp	-55°C to 100°C
Continuous forward current (note 3)	.2 A
Peak forward current (note 3) (1μs pulse width 300 pps)	25 A
Reverse voltage	.3 V

ELECTRO-OPTICAL CHARACTERISTICS

(25° C Case Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Total external radiated power (see note 1)					
ME2A	7.5	9.0		mW	I_F=1.0 A
ME5A		14		mW	I_F=2.0 A
ME2	10	12		mW	I_F=1.0 A
ME5		18		mW	I_F=2.0 A
Peak emission wavelength		9000		Å	
Spectral line half width		400		Å	
Forward voltage		1.3	1.5	V	I_F=1.0 A
Capacitance		750		pF	V=0
Light rise time or fall time		10		ns	
Reverse voltage	3.0			V	I_R=30 μA

ME2 ME2A ME5 ME5A

TYPICAL THERMAL CHARACTERISTICS

Thermal resistance junction to case (Θ_{JA})	25°C/W
Wavelength temperature coefficient (case temperature)	2.8 Å/°C
Forward voltage temperature coefficient	-1.8 mV/°C

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

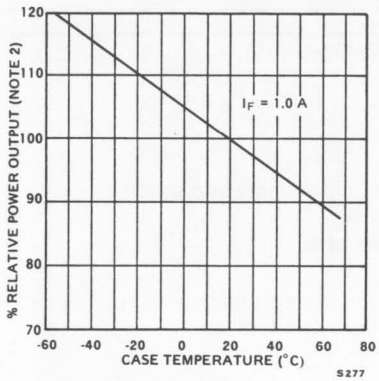


Figure 1 % Relative Power Output vs. Case Temperature

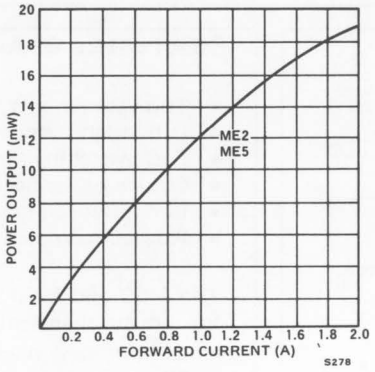


Figure 2 Power Output vs. Forward Current

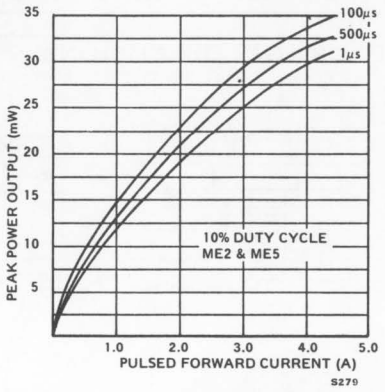


Figure 3 Peak Output Power vs. Pulsed Forward Current

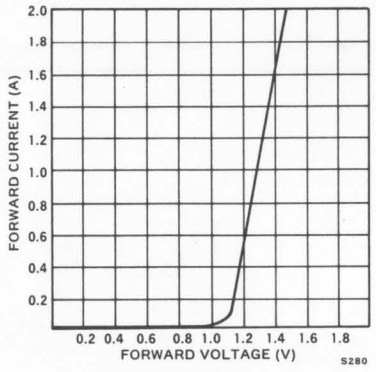


Figure 4 Forward Current vs. Forward Voltage

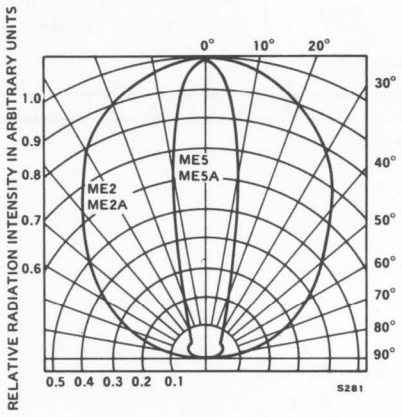


Figure 5 Spacial Distribution

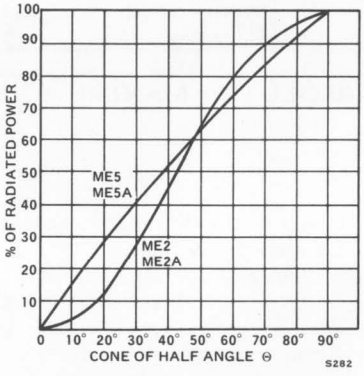


Figure 6 Percent of Radiated Power into Cone of Half Angle Θ

NOTES

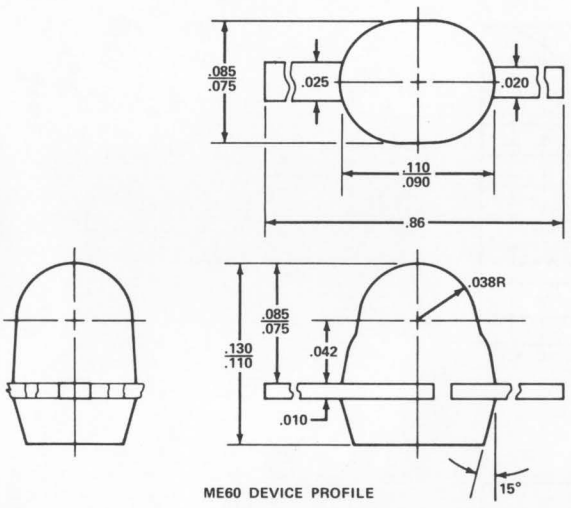
1. *The total external radiated power output measurements are made with a Centralab 2A solar cell terminated into a 10Ω impedance.*
2. *The curves in Figure 1 are normalized to the power output at 25°C to indicate the relative efficiency over the operating temperature range.*
3. *Units must be sufficiently heat sunk above 150mA input current.*

Monsanto INFRARED EMITTER | ME60

PRODUCT DESCRIPTION

The ME60 is a diffused planar gallium arsenide infrared diode. The lead-frame construction is encapsulated in an epoxy case and lens.

PACKAGE DIMENSIONS



ME60 DEVICE PROFILE

FEATURES

The ME60 is intended for high volume infrared source application where low cost, high reliability and high density packaging are required.

- Low Cost
- Compatible with integrated circuits
- Long life, rugged
- Small Size
- Easily assembled in linear arrays
- Card & tape reader sources
- High on-axis power

ABSOLUTE MAXIMUM RATINGS

Power dissipation - 25°C ambient	75 mW
Derate linearly from 25°C	1.0mW/°C
Storage & operating temperature	-55°C to 100°C
Lead solder time @260°C (See Note 1)	10 sec
Continuous forward current	50 mA
Reverse voltage	3.0V

ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Total external radiated power (see note 2)	400	550		μW	I_F = 50 mA
Peak emission wave length		9000		Å	
Spectral line half-width		400		Å	
Forward voltage		1.3	1.5	V	I_F = 50 mA
Reverse current		.15	10	μA	V_R = 3.0 volts
Light turn-on and turn-off		1		ns	
Capacitance		80		pF	V=0

ME60

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

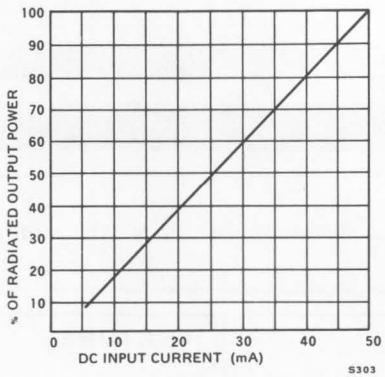


Figure 1

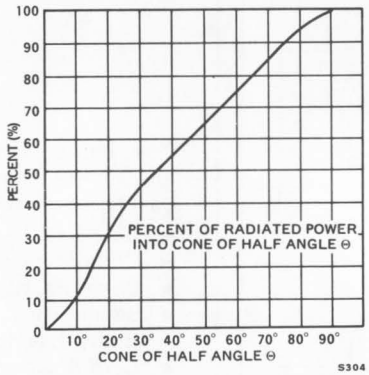


Figure 2

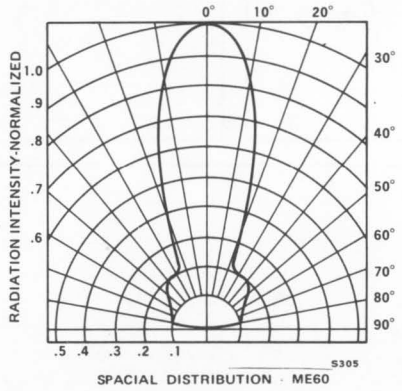


Figure 3

NOTES

1. *The leads of the device were immersed in molten solder, heated to a temperature of 260°C, to a point 1/16 inch from the body of the device per MIL-S-750.*
2. *The total external radiated power output measurements are made with a Centralab 110C solar cell terminated into a 100Ω impedance.*

Monsanto

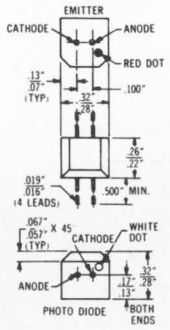
PHOTODIODE COUPLED PAIR

MCD1

PRODUCT DESCRIPTION

The MCD1 is a photodiode coupled pair consisting of a diffused planar GaAs diode emitter and a diffused planar silicon PIN photodiode. It is encapsulated in clear epoxy for light transmission and then opaque black epoxy for protection.

PACKAGE DIMENSIONS



FEATURES

- Ultra fast switching time--typically 5 nanoseconds
- Very high isolation resistance; $10^{11}\,\Omega$
- 2,500 volt emitter-to-detector isolation
- Excellent performance in linear and digital circuits.
- Long life--solid state reliability.
- Compact, rugged, and lightweight.

ABSOLUTE MAXIMUM RATINGS

Storing and Operating Temperature - -55° to 100°C

EMITTER (GaAs diode)

Power Dissipation @ 25°C Ambient Temperature	150 mW
Derate Linearly from 25°C	2.0 mW/°C
Continuous Forward Current	100 mA
Peak Forward Current (1μsec pulse, 300 pps)	3.0 amps
Reverse Voltage	3.0 volts

DETECTOR (Silicon PIN photodiode)

Power Dissipation @ 25°C Ambient Temperature	100 mW
Derate Linearly from 25°C	1.33 mW/°C
Reverse Voltage	50 volts

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Emitter					
Forward voltage		1.3	1.5	V	I_F=100 mA
Reverse current		0.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
Breakdown voltage	50	75		V	I_R=10 μA
Dark current		15	50	nA	V_R=20 V
Capacitance		40		pF	V=0
Capacitance		10		pF	V_R=20 V
Coupled Pair					
DC current transfer ratio	0.15	0.2		%	Note 1
Bandwidth (see figure 6)		8.5		MHz	Note 2
Capacitance		3		pF	
Resistance		10^{11}		Ω	
Breakdown voltage	2500			V	
Rise and fall time		5		ns	

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

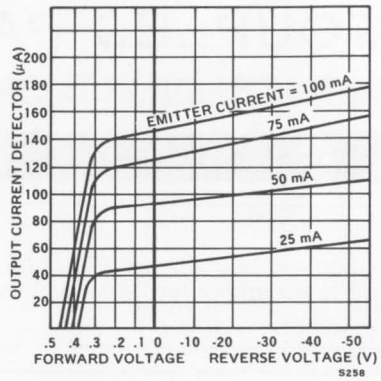


Figure 1 Output Current vs. Voltage

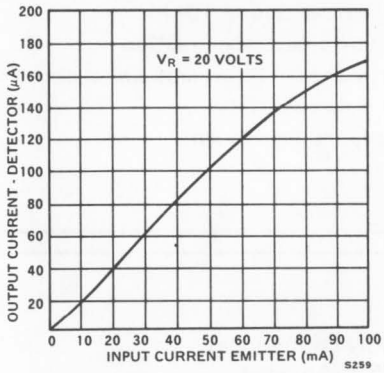


Figure 2 Output Current vs. Input Current

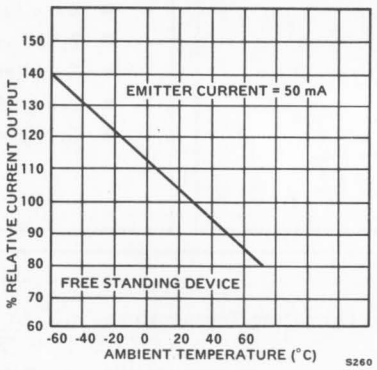


Figure 3 Current vs. Temperature

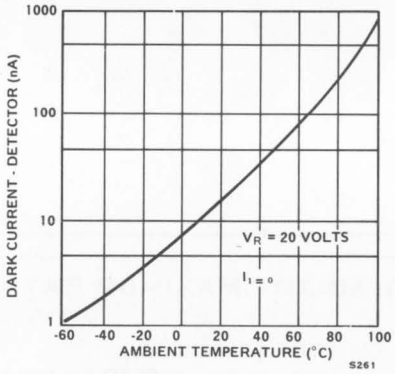


Figure 4 Dark Current vs. Temperature

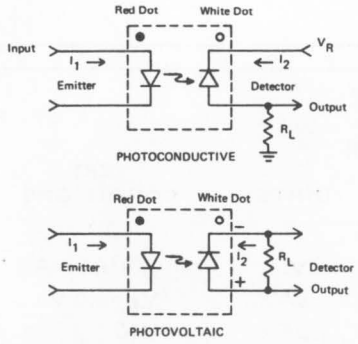


Figure 5 Typical Operating Schematics

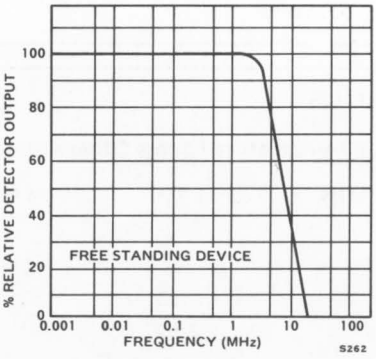


Figure 6 Output vs. Frequency

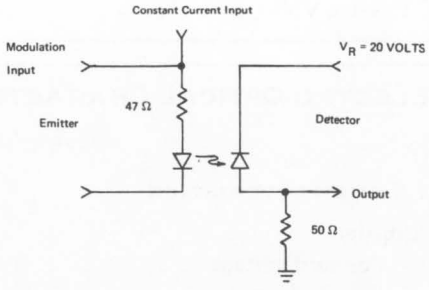


Figure 7 Modulation Circuit Used to Obtain Figure 6

NOTES

1. *The current transfer ratio (I_2/I_1) is the ratio of detector output current @ V_R = 20 volts, to the emitter input current. This ratio is linear to within ±5% for an emitter input from 20 mA to 80 mA.*
2. *The frequency at which the time-averaged sinusoidal current ratio is half the DC current value.*

Monsanto

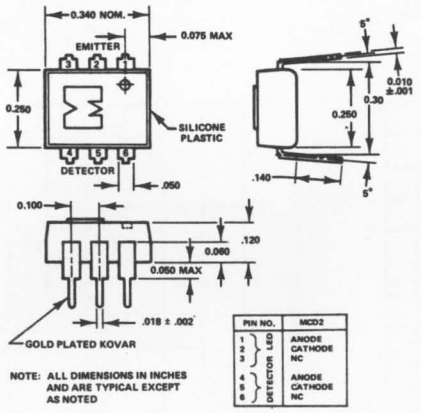
PHOTODIODE COUPLED PAIR

MCD2

PRODUCT DESCRIPTION

The MCD2 is a diffused planar silicon PIN photodiode optically coupled to a diffused planar gallium arsenide light-emitting diode. It is mounted in a six-lead plastic DIP.

PACKAGE DIMENSIONS



NOTE: ALL DIMENSIONS IN INCHES AND ARE TYPICAL EXCEPT AS NOTED

FEATURES & APPLICATIONS

- Ultra fast switching time - typically 5 nanoseconds
- Very high isolation resistance - 10^{11} Ω
- 1500 volt isolation emitter to detector
- Plastic dual-in-line package
- Long life - solid state reliability
- Excellent performance in linear and digital circuits
- Compact, rugged, light weight
- Low coupling capacitance 1.3pF

♦

The MCD2 is intended for applications where a high degree of input to output isolation is required to provide unilateral signal transfer with ultra fast speed of response such as in:

- High speed isolated amplifiers
- High speed pulse transformers
- High frequency opto-electronic feedback circuits
- High speed isolated logic switch

ABSOLUTE MAXIMUM RATINGS

Storage temperature - 55°C to 150°C
Operating temperature - -55°C to 100°C
Lead soldering time @ 260°C - 7.0 seconds

LED (GaAs Diode)
Power dissipation @25°C ambient 150mW
Derate linearly from 25°C . . . . . 2.0mW/°C
Continuous forward current 100mA
Reverse voltage . . . . . 3.0 volts
Peak forward current (1μsec pulse, 300 pps) . . . . . 3.0 Amp

DETECTOR (Silicon PIN Photo Diode)
Power dissipation @ 25°C ambient 100mW
Derate linearly from 25°C . . . . . 1.33mW/°C
Reverse voltage . . . . . 50 volts

ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Emitter					
Forward voltage		1.3	1.5	V	I_F=100 mA
Reverse current		0.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
Reverse breakdown voltage	50	75		V	I_R=10 μA
Dark current (I_R)		15	50	nA	V_R=20 V
Capacitance		10		pF	V_R=20 V
Capacitance		40		pF	V=0
Coupled					
DC current transfer ratio	0.15	0.2		%	note 1
Breakdown voltage	1500			V	
Resistance emitter-detector		10^{11}		Ω	V_{E-D} = 500 V
Capacitance LED detector		1.3		pF	
Bandwidth (see figure 6)		8.5		MHz	note 2
Rise and fall time		5		ns	

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

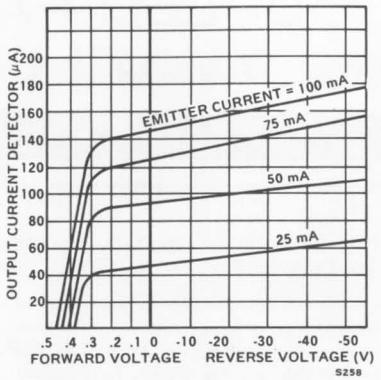


Figure 1 Output Current vs. Voltage

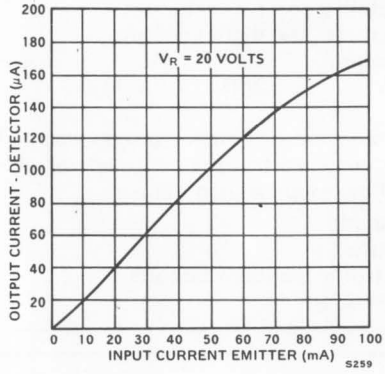


Figure 2 Output Current vs. Input Current

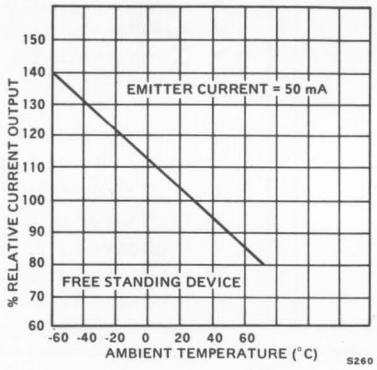


Figure 3 Current vs. Temperature

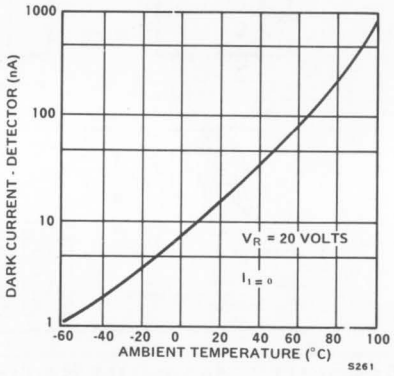


Figure 4 Dark Current vs. Temperature

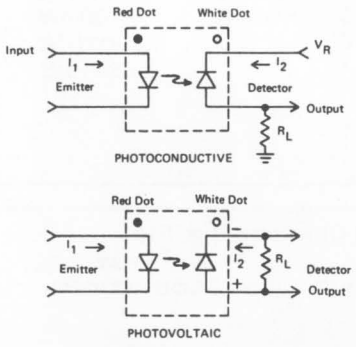


Figure 5 Typical Operating Schematics

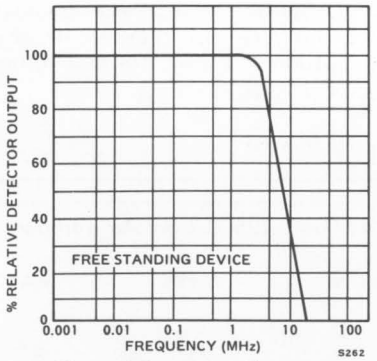


Figure 6 Output vs. Frequency

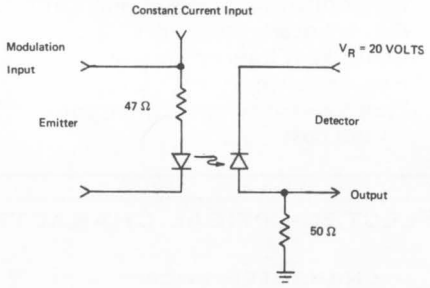


Figure 7 Modulation Circuit Used to Obtain Figure 6

NOTES

1. *The current transfer ratio (I_2/I_1) is the ratio of detector output current @V_R = 20 volts, to the emitter input current. This ratio is linear to within ±5% for an emitter input from 20 mA to 80 mA.*
2. *The frequency at which the time-averaged sinusoidal current ratio is half the DC current value.*

Monsanto

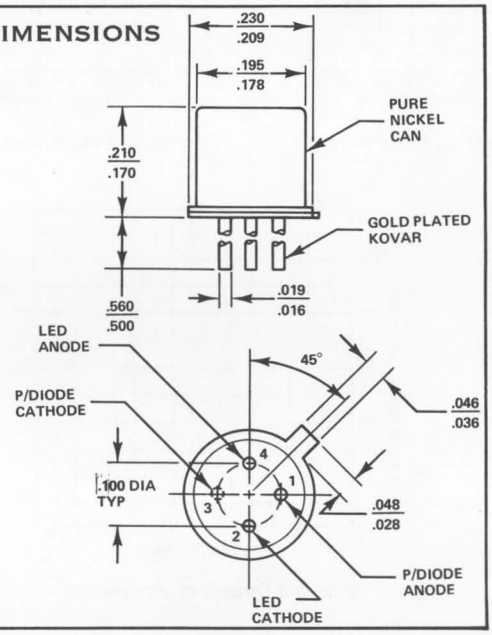
PHOTO DIODE COUPLED PAIR

MCD4

PRODUCT DESCRIPTION

The MCD4 is a standard four-lead, TO18 package containing a gallium arsenide light-emitting diode optically coupled to a silicon planar PIN photodiode. It is hermetically sealed for Military Applications.

PACKAGE DIMENSIONS



FEATURES & APPLICATIONS

- Ultra fast switching time
- Very high isolation resistance - $10^{11}\,\Omega$
- 1500 volt isolation emitter to detector
- Hermetic package
- Long life - solid state reliability
- Excellent performance in linear and digital circuits
- Compact, rugged, light weight
- Low coupling capacitance . . . . 1.8 pF

♦

The MCD4 is intended for applications where a high degree of input to output isolation is required to provide unilateral signal transfer with ultra fast speed of response such as in:

- High speed isolated amplifier
- High speed pulse transfers
- High frequency opto-electronic feedback circuits
- High speed isolated logic switch

ABSOLUTE MAXIMUM RATINGS

Storage temperature -65°C to 150°C
Operating temperature -55°C to 125°C
Lead soldering time @260°C - 10.0 seconds

LED (GaAs Diode)
Power dissipation @ 25°C ambient . . . . . 150 mW
Derate Linearly from 25°C . . . . . .1.5 mW/°C
Continuous forward current . . . . . 100 mA
Reverse voltage . . . . . .3.0 V
Peak forward current (1 μs pulse, 300 pps) . . .3.0 A

DETECTOR (PIN photodiode)
Power dissipation @25°C ambient . . . . . 100 mW
Derate linearly from 25°C . . . . . .1.0 mW/°C
Reverse voltage . . . . . 50 V

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Emitter					
Forward voltage		1.3	1.5	V	I_F=100 mA
Reverse current		0.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
Reverse breakdown voltage	50	75		V	I_R=10 μA
Dark current		5	25	nA	V_R=20 V
Capacitance		10		pF	V_R=20 V
Capacitance		40		pF	V=0
Coupled					
DC current transfer ratio	0.10	0.15		%	V_R=20 V
Breakdown voltage	1000			V	
Resistance emitter-detector		10^{11}		Ω	V_{E-D} = 500 V
Capacitance LED to detector		1.8		pF	
Bandwidth (see figure 6)		8.5		MHz	note 2
Rise time and fall time		20		ns	50 Ω system

MCD4

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

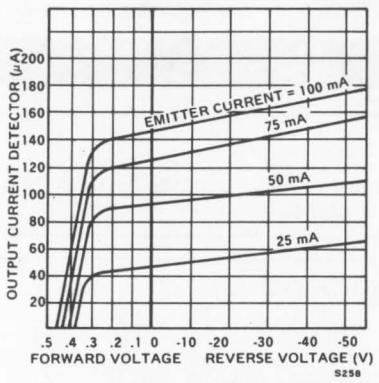


Figure 1 Output Current vs. Voltage

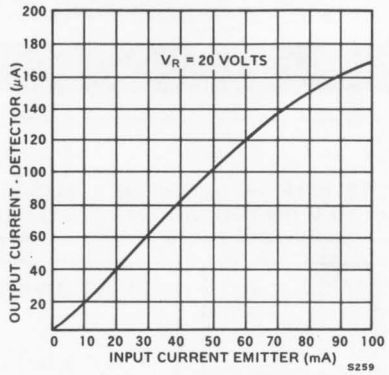


Figure 2 Output Current vs. Input Current

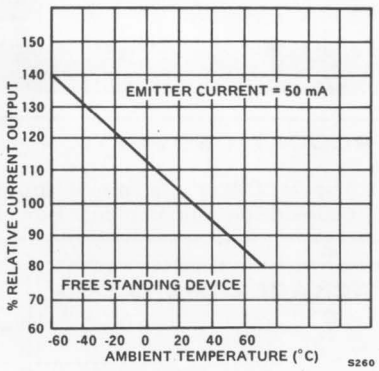


Figure 3 Current vs. Temperature

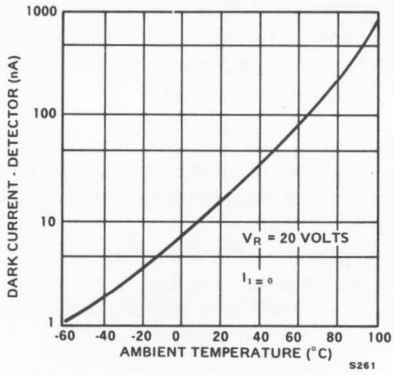


Figure 4 Dark Current vs. Temperature

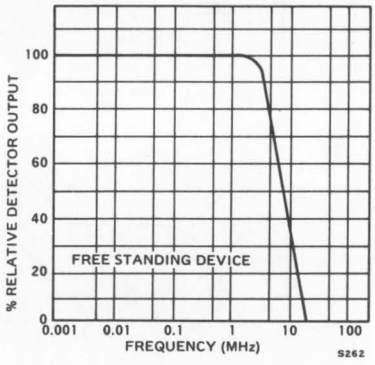


Figure 6 Output vs. Frequency

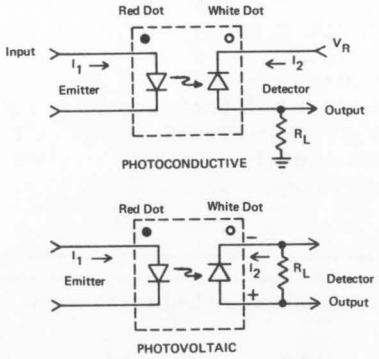


Figure 5 Typical Operating Schematics

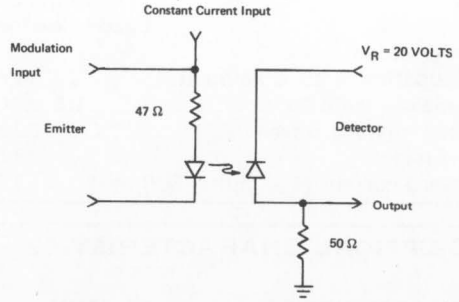


Figure 7 Modulation Circuit Used to Obtain Figure 6

NOTES

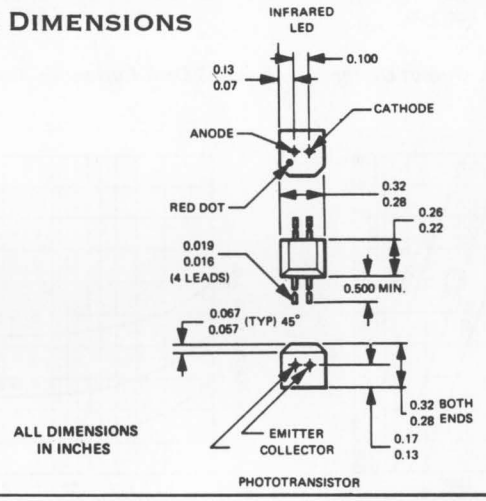
1. *The current transfer ratio (I_2/I_1) is the ratio of detector output current @ V_R = 20 volts, to the emitter input current. This ratio is linear to within ±5% for an emitter input from 20 mA to 80 mA.*
2. *The frequency at which the time-averaged sinusoidal current ratio is half the DC current value.*

Monsanto PHOTOTRANSISTOR COUPLED PAIR | MCT1

PRODUCT DESCRIPTION

The MCT1 is a phototransistor coupled pair consisting of a diffused planar GaAs diode emitter and a NPN silicon planar phototransistor. It is encapsulated in clear epoxy for light transmission and then in black opaque epoxy for protection.

PACKAGE DIMENSIONS



FEATURES

- High-speed, solid-state switch
- Very high current transfer ratio . . . typically 35%
- Input and output compatible with integrated circuits
- Very high isolation resistance . . . 10^{11} ohms
- 2500 volt isolation emitter to detector
- Long life; solid-state relability

ABSOLUTE MAXIMUM RATINGS

Storing and operating temperature -55°C to 100°C
Lead soldering time @ 260°C - 7.0 seconds

LED (GaAs diode)
Power dissipation @ 25°C ambient . . . . . 150 mW
Derate linearly from 25°C . . . . . 2.0 mW°C
Continuous forward current . . . . . 60 mA
Peak forward current (1μsec pulse, 300 pps) . . . . . .3.0 A
Reverse voltage . . . . . .3.0 V

DETECTOR (Silicon phototransistor)
Power dissipation @ 25°C ambient . . . . . 200 mW
Derate linearly from 25°C . . . . . 2.67 mW/°C
Collector - emitter breakdown voltage (BV_{CEO}) . . . . . 30 V
Emitter - collector breakdown voltage (BV_{ECO}) . . . . . .7.0 V

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
LED					
Forward voltage		1.3	1.5	V	I_F=100 mA
Reverse current		0.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
Breakdown voltage collector to emitter	30			V	I_C=1.0 mA, I_F=0
Breakdown voltage emitter to collector	7	12		V	I_E=100 μA, I_F=0
Collector dark current		2	75	nA	V_{CE}=10 V
Capacitance collector to emitter		10		pF	V_{CE}=10V
Coupled					
DC current transfer ratio	20	35		%	I_F=10 mA, V_{CE}=10 V(note 1)
Bandwidth (see figure 5)		300		kHz	I_C=2 mA (note 2)
Saturation voltage collector to emitter		0.1		V	I_C=500 μA, I_F=10 mA
		0.2	0.5	V	I_C=4 mA, I_F=100 mA
Resistance LED to detector		10^{11}		Ω	
Breakdown voltage	2500			V	
Rise and fall time (see operating schematics)		2		μs	I_C=2 mA, V_{CE}=10 V (note 3)
Capacitance LED to detector		2.0		pF	

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

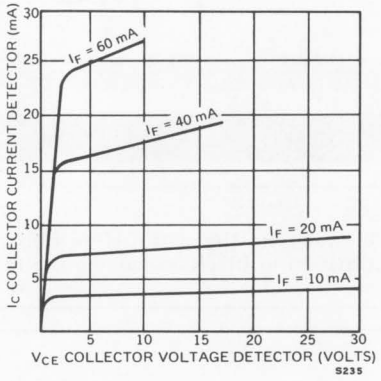


Figure 1 Detector Output Characteristics

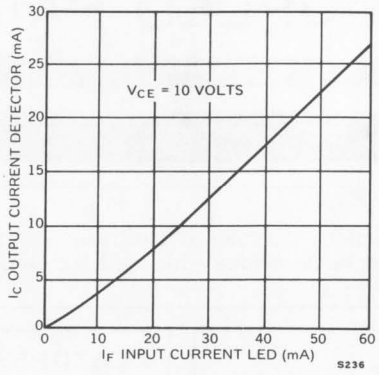


Figure 2 Input Current vs. Output Current

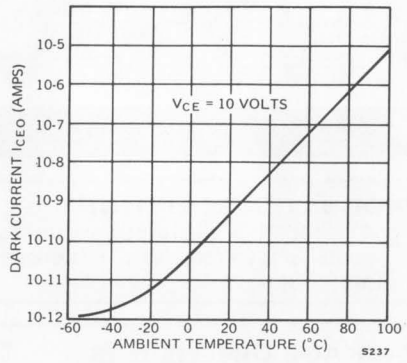


Figure 3 Dark Current vs. Temperature (°C)

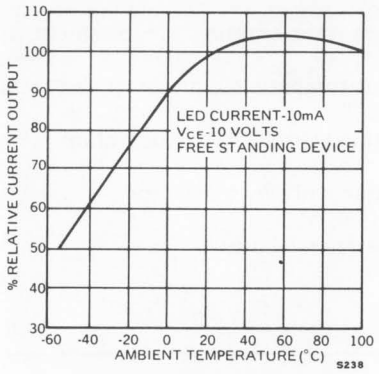


Figure 4 Current Output vs. Temperature

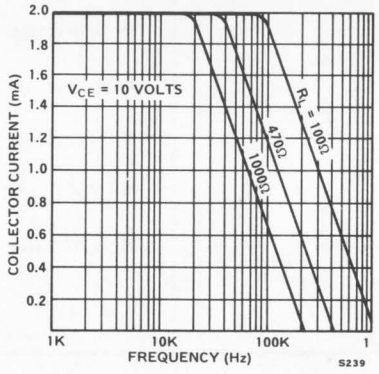


Figure 5 Output vs. Frequency

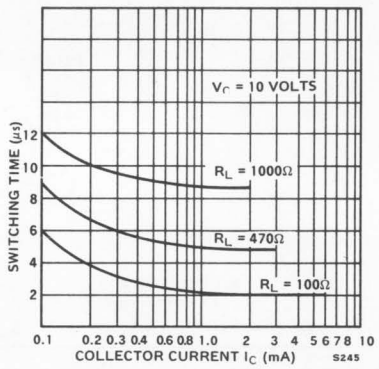
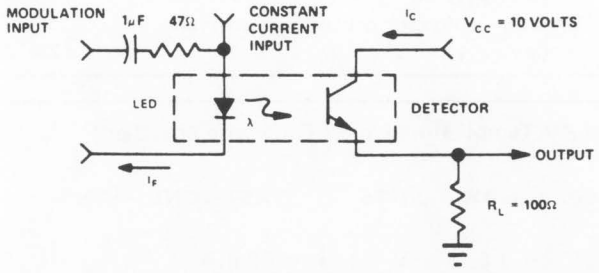
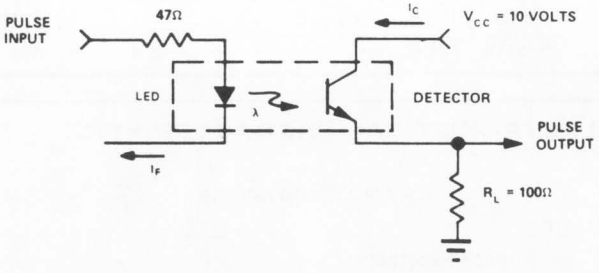


Figure 6 Switching Time vs. Collector Current

OPERATING SCHEMATICS



Modulation Circuit Used to Obtain Output vs Frequency Plot



Circuit Used to Obtain Switching Time vs Collector Current Plot

NOTES

1. *The current transfer ratio (I_C/I_F) is the ratio of the detector collector current to the LED input current with V_{CE} at 10 Volts.*
2. *The frequency at which the time averaged sinusoidal current ratio is half the direct current value.*
3. *Rise time (t_r) is the time required for the collector current to increase from 10% of its final value, to 90%.*

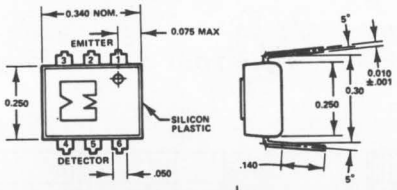
   Fall time (t_f) is the time required for the collector current to decrease from 90% of its initial value, to 10%.

Monsanto PHOTOTRANSISTOR OPTO-ISOLATOR | MCT2

PRODUCT DESCRIPTION

The MCT2 is a NPN silicon planar phototransistor coupled to a diffused planar gallium arsenide diode. It is mounted in a six-lead plastic DIP.

PACKAGE DIMENSIONS



NOTE: ALL DIMENSIONS IN INCHES AND ARE TYPICAL EXCEPT AS NOTED

PIN NO.		MCT2
1	LED	ANODE
2	LED	CATHODE
3	LED	NC
4	DETECTOR	EMITTER
5	DETECTOR	COLLECTOR
6	DETECTOR	BASE

FEATURES & APPLICATIONS

- High current transfer ratio . . . typically 35%
- High isolation resistance . . . 10^{11} Ω
- 1500 volt isolation emitter to detector
- Plastic dual-in-line package
- Long life-solid state reliability
- Compact, rugged, light weight
- Low coupling capacitance . . . 1.3 pF is typical

◆

Typical applications would be:

- Systems isolation
- Chassis isolation
- General purpose switching
- High voltage power supply control
- Phase control

ABSOLUTE MAXIMUM RATINGS

Storage temperature -55°C to 150°C
Operating temperature -55°C to 100°C
Lead soldering time @ 260°C 7.0 seconds

LED (GaAs Diode)
Power dissipation @25°C ambient . . . . . 100 mW
Derate linearly from 25°C . . . . . 1.33 mW/°C
Continuous Forward Current . . . . . 60 mA
Reverse Voltage 3.0V
Peak forward current 3.0A
Peak forward current (1 μs pulse, 300 pps) . . 3.0A

DETECTOR (Silicon phototransistor)
Power dissipation @25°C ambient . . . . . 150 mW
Derate linearly from 25°C . . . . . 2.0 mW/°C
Collector-emitter breakdown voltage (BV_{CEO}) . 30V
Emitter-collector breakdown voltage (BV_{ECO}) . 7.0V
Collector-base breakdown voltage (BV_{CBO}) . . 70V

ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Emitter					
Forward voltage		1.3	1.5	V	I_F=100 mA
Reverse current		.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
h_{FE}	100	150			V_{CE}=5 V, I_C=100 μA
BV_{CEO}	30			V	I_C=1.0 mA, I_F=0
BV_{ECO}	7	12		V	I_C=100 μA, I_F=0
I_{CEO}(dark)		5	50	nA	V_{CE}= 10 V, I_F=0
Capacitance Collector-emitter		2		pF	V_{CE}=0
BV_{CBO}	70			V	I_C=10 μA
I_{CBO}(Dark)			20	nA	V_{CB}=10 V, I_F=0
Coupled					
DC current transfer ratio	20	35	100	%	V_{CE}=10 V, Note 1
Breakdown voltage	1500			V	
Resistance emitter-detector		10^{11}		Ω	V_{E-D}=500 V
V_{CE}(sat)		0.1		V	I_C=500 μA, I_F=10 mA
		0.2	0.5	V	I_C=2 mA, I_F=50 mA
Capacitance LED to detector		1.3		pF	
Bandwidth (see figure 5)		300		kHz	I_C=2 mA, note 2
Rise time and fall time (see operating schematics)		2		μs	I_C=2 mA, V_{CE}=10 V, note 3

MCT2

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

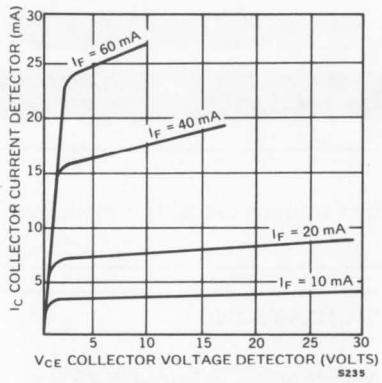


Figure 1 Detector Output Characteristics

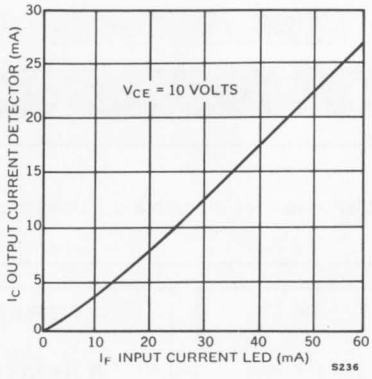


Figure 2 Input Current vs. Output Current

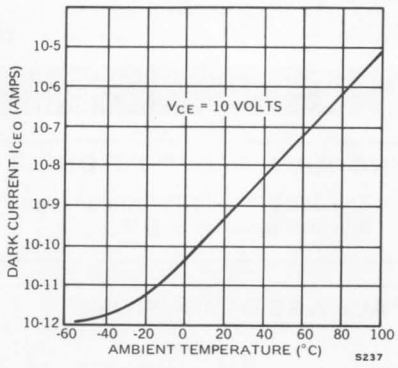


Figure 3 Dark Current vs. Temperature (°C)

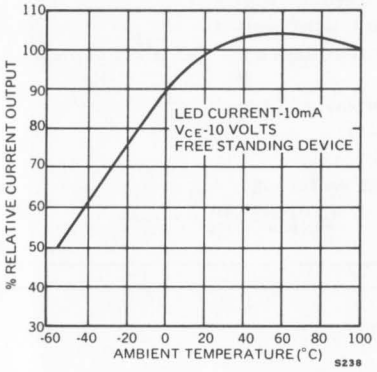


Figure 4 Current Output vs. Temperature

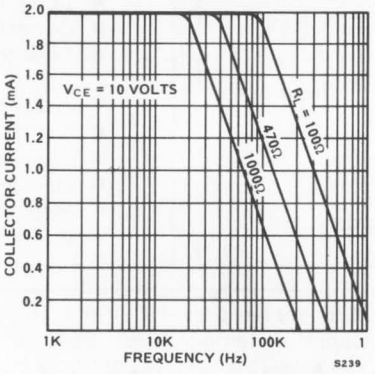


Figure 5 Output vs. Frequency

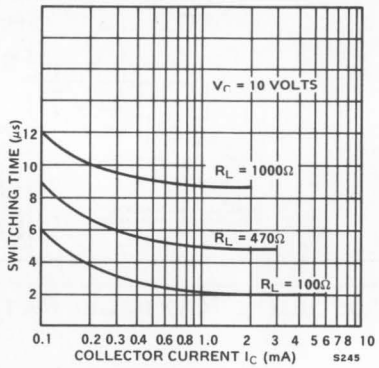
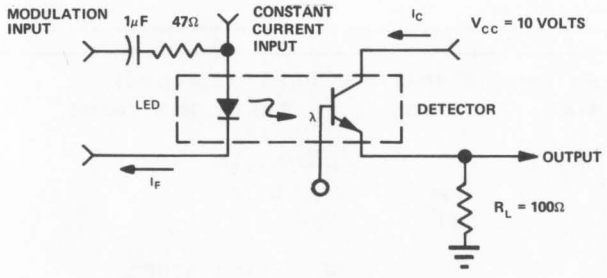
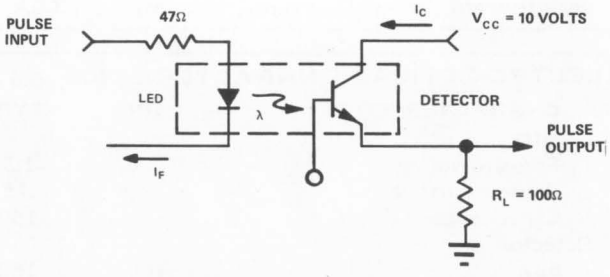


Figure 6 Switching Time vs. Collector Current

OPERATING SCHEMATICS



Modulation Circuit Used to Obtain Output vs Frequency Plot



Circuit Used to Obtain Switching Time vs Collector Current Plot

NOTES

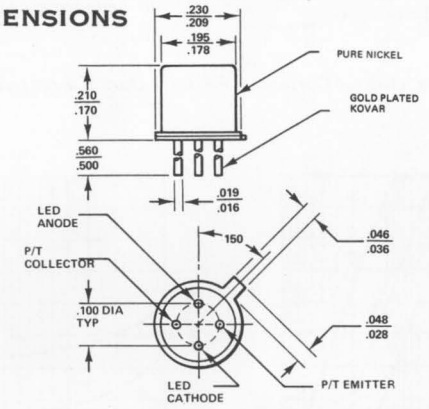
1. *The current transfer ratio (I_C/I_F) is the ratio of the detector collector current to the LED input current with V_{CE} at 10 volts.*
2. *The frequency at which the time averaged sinusoidal current ratio is half the direct current value.*
3. *Rise time (t_r) is the time required for the collector current to increase from 10% of its final value, to 90%. Fall time (t_f) is the time required for the collector current to decrease from 90% of its initial value to 10%.*

Monsanto PHOTOTRANSISTOR COUPLED PAIR | MCT4

PRODUCT DESCRIPTION

The MCT4 is a standard four-lead, TO-18 package containing a GaAs light emitting diode optically coupled to a silicon planar phototransistor. It is a diffused planar GaAs diode and n-p-n silicon planar phototransistor.

PACKAGE DIMENSIONS



FEATURES

- Hermetic package
- High current transfer ratio; typically 35%
- High isolation resistance; 10^{11} ohms at 500 volts
- High voltage isolation emitter to detector

ABSOLUTE MAXIMUM RATINGS

Storage temperature - -65°C to 150°C
Operating temperature - -55°C to 125°C
Lead soldering time @ 260°C - 10.0 seconds

LED(GaAs Diode)
Power dissipation=25°C ambient . . . . . 60 mW
Derate linearly from 25°C . . . . . 0.6 mW/°C
Continuous forward current . . . . . 40 mA
Reverse voltage . . . . . 3.0 volts
Peak forward current . . . . . 3.0 A
(1 μs pulse, 300 pps)

DETECTOR (Silicon phototransistor)
Power dissipation=25°C ambient . . . . . 190 mW
Derate linearly from 25°C . . . . . 1.9 mW/°C
Collector-emitter breakdown voltage
(BV_{CEO}) . . . . . 30 volts
Emitter-collector breakdown voltage
(BV_{ECO}) . . . . . 7.0 volts

ELECTRO-OPTICAL CHARACTERISTICS

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Emitter					
Forward voltage		1.3	1.5	V	I_F=40 mA
Reverse current		.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
BV_{CEO}	30			V	I_C=1.0 mA, I_F=0
BV_{ECO}	7	12		V	I_C=100 μA, I_F=0
I_{CEO}(Dark)		5	50	nA	V_{CE}=10 V, I_F=0
Capacitance collector-emitter		2		pF	V_{CE}=0
Coupled					
DC current transfer ratio	15	35		%	I_F=10 mA, V_{CE}=10 V
Breakdown voltage	1000	1500		V	
Resistance emitter-detector		10^{11}		ohms	V_{E-D}=500 V
$V_{CE(SAT)}$		0.1		V	I_C=500μA, I_F= 10 mA
		0.2	0.5	V	I_C=2 mA, I_F=50 mA
Capacitance LED to detector		1.8		pF	
Bandwidth (see figure 5)		300		kHz	Note 2
Rise time and fall time (see operating schematic)		2		μs	I_C=2 mA, V_{CE}=10 V Note 3

MCT4

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

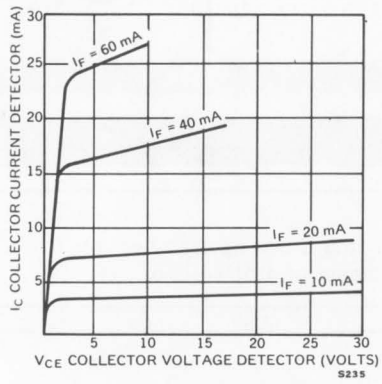


Figure 1 Detector Output Characteristics

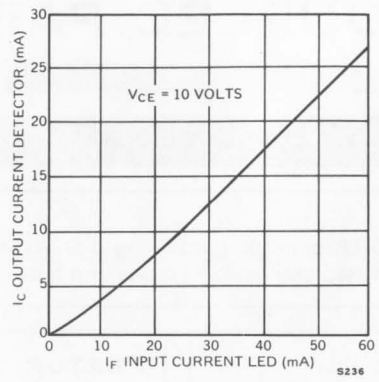


Figure 2 Input Current vs. Output Current

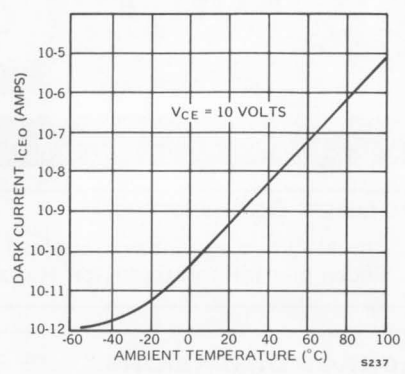


Figure 3 Dark Current vs. Temperature (°C)

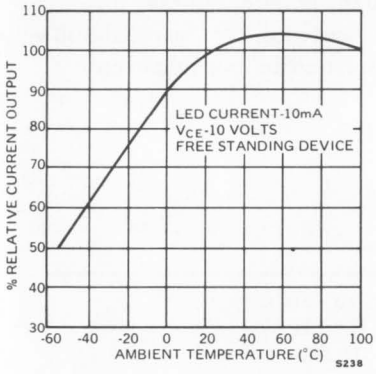


Figure 4 Current Output vs. Temperature

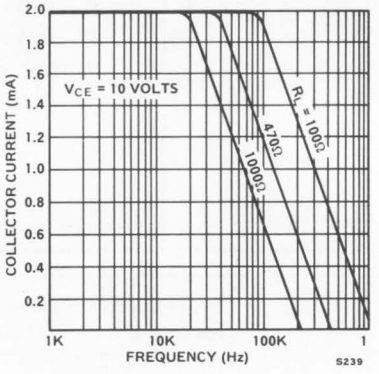


Figure 5 Output vs. Frequency

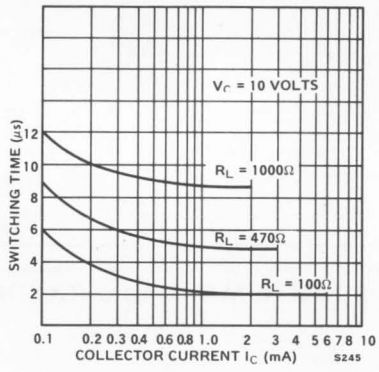
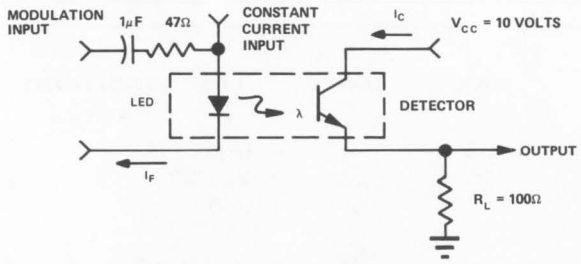
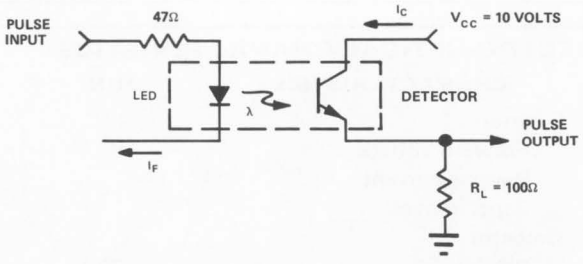


Figure 6 Switching Time vs. Collector Current

OPERATING SCHEMATICS



Modulation Circuit Used to Obtain Output vs. Frequency Plot



Circuit Used to Obtain Switching Time vs. Collector Current Plot

NOTES

1. *The current transfer ratio (I_C/I_F) is the ratio of the detector collector current to the LED input current with V_{CE} at 10 volts.*
2. *The frequency at which the time averaged sinusoidal current ratio is half the direct current value.*
3. *Rise time (t_r) is the time required for the collector current to increase from 10% of its final value, to 90%. Fall time (t_f) is the time required for the collector current to decrease from 90% of its initial value to 10%.*

Monsanto

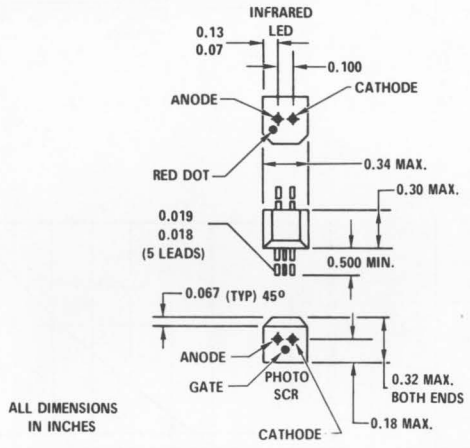
PHOTO SCR COUPLED PAIR

MCSI

PRODUCT DESCRIPTION

The MCS1 is a photo SCR coupled pair consisting of a diffused planar GaAs diode emitter and a PNPN planar photo SCR. It is encapsulated in clear epoxy for light transmission and then in black opaque epoxy for protection.

PACKAGE DIMENSIONS



FEATURES

- Built-In Memory
- A-C Switch (SPST)
- High Current Carrying Capability (Pulsed Condition)
- High Isolation Resistance - $10^{11}\ \Omega$
- 2500 Voltage Isolation

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The Photo SCR coupled pair is intended for applications where complete electrical isolation is required between low power circuitry such as integrated circuits and AC line voltages providing high speed switching or relay functions. Its bi-stable characteristics lends itself for use as a latching relay in direct-current circuits.

ABSOLUTE MAXIMUM RATINGS

Storage and Operating Temperature -55°C to 100°C
Lead Soldering Time @ 260°C 7.0 seconds

LED (GaAs Diode)

Power Dissipation @ 25°C	150 mW
Derate Linearly from 25°C	2.0 mW/°C
Continuous Forward Current	60 mA
Peak Forward Current (1μs Pulse, 300 pps)	3.0 A
Reverse Voltage	3.0 V

DETECTOR (Photo SCR)

Power Dissipation @ 25°C	250 mW
Derate Linearly from 25°C	3.3 mW/°C
Continuous Forward Current	200 mA
Surge Current, 8 ms (See Note 1)	5 A
Peak Gate Current	250 mA
Average Gate Current	25 mA
Reverse Gate Voltage	5 V
Anode Voltage (DC or Peak AC)	200 V

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
LED					
Forward voltage (V_F)		1.3	1.5	V	I_F=50 mA
Reverse current (I_R)		.15	10	μA	V_R=3.0 V
Capacitance		150		pF	V=0
Detector					
Forward blocking voltage (V_{AX})	200			V	R_{GK}=27 KΩ
Forward blocking current (I_{AX})		.6		μA	V_{CC}=50 V, R_{GK}=27 KΩ
Anode on voltage (V_{AK})		.9	1.5	V	I_A=200 mA
Holding current (I_H)		.1		mA	V_{CC}=50 V, R_{GK}=27 KΩ
Coupled					
Turn on current (I_F)		4		mA	V_{CC}=50 V, R_{GK}= 27KΩ
t_{on} (t_r+t_d) (see note 2)		1.5		μA	I_F=100 mA, R_{GK}=27KΩ V_{CC}=50 V
Resistance LED to SCR		10^{11}		Ω	
Breakdown voltage - LED to SCR	2500			V	
Capacitance - LED to SCR		2.0		pF	

TYPICAL ELECTRO-OPTICAL CHARACTERISTICS CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

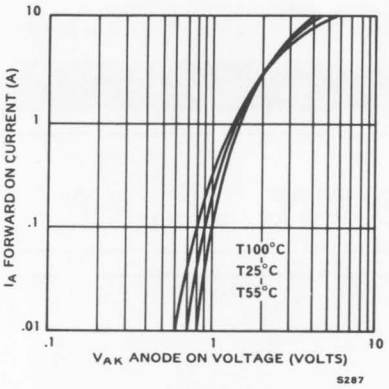


Figure 1 I_A vs. V_{AK}

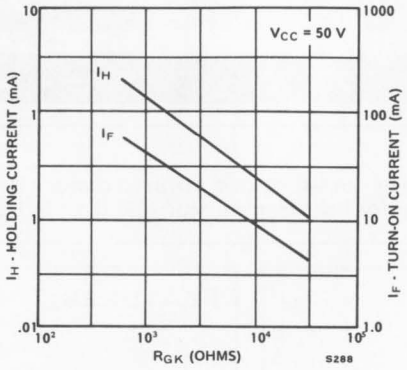


Figure 2 I_H vs. R_{GK} - I_F vs. R_{GK}

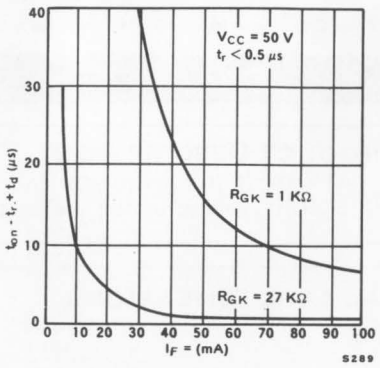


Figure 3 t_{on} vs I_F

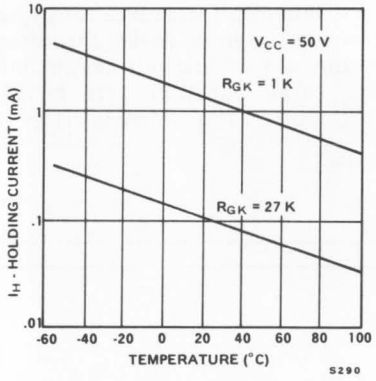


Figure 4 I_H vs. Temperature

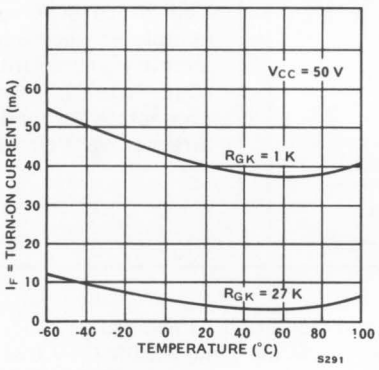


Figure 5 I_F vs. Temperature

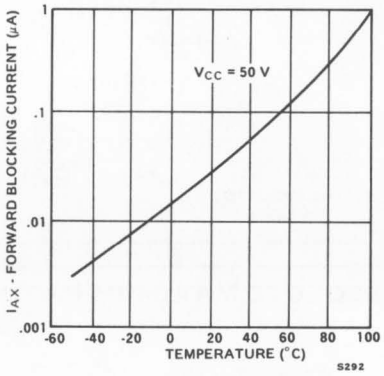
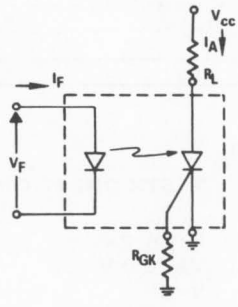
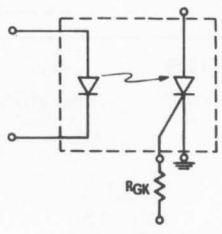


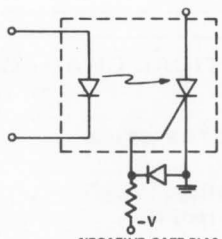
Figure 6 I_{AX} vs. Temperature

OPERATING SCHEMATICS



GATE BIAS CONSIDERATIONS





NOTES

1. *The maximum peak current depends on the duty cycle so as to stay within the average power of the device.*
2. *The rise time of the SCR is less than 500 nanoseconds.*
3. *For design information send for GaAs Lite Tip No. 4.*

Monsanto

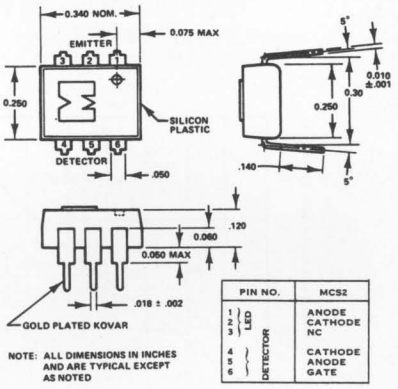
PHOTO SCR COUPLED PAIR

MCS2

PRODUCT DESCRIPTION

The MCS2 is a PNPN planar photo SCR coupled to a diffused planar gallium arsenide infrared diode. It is mounted in a six-lead plastic DIP.

PACKAGE DIMENSIONS



FEATURES & APPLICATIONS

- Built-in memory
- AC switch (SPST)
- High current carrying capability (pulsed condition)
- Plastic dual-in-line package
- High isolation resistance - $10^{11}\ \Omega$
- 1500 volt isolation, emitter to detector
- Compact, rugged, light-weight
- Low coupling capacitance . . . 1.3pF typical

◆

The Photo SCR coupled pair is intended for applications where complete electrical isolation is required between low power circuitry such as integrated circuits and AC line voltages providing high speed switching or relay functions. Its bi-stable characteristics lends itself for use as a latching relay in direct-current circuits. (See note 3).

ABSOLUTE MAXIMUM RATINGS

Storage temperature -55°C to 150°C
Operating temperature -55°C to 100°C
Lead soldering time @260°C 7.0 seconds

LED (GaAs Diode)
Power dissipation @ 25°C ambient . . . . . 60 mW
Derate linearly from 25°C . . . . . 0.8 mW/°C
Continuous forward current . . . . . 40 mA
Reverse voltage . . . . . 3.0 volts
Peak forward current . . . . . 3.0 A
(1 μs pulse, 300 pps)

DETECTOR (Photo SCR)
Power dissipation @ 25°C ambient . . . . . 200 mW
Derate linearly from 25°C . . . . . 2.67 mW/°C
Continuous forward current . . . . . 140 mA
Surge current, rms (See note 1) . . . . . 5 A
Peak gate current . . . . . 200 mA
Average gate current . . . . . 25 mA
Reverse gate current . . . . . 5 V
Anode voltage (DC or peak AC) . . . . . 200 V

ELECTRO-OPTICAL CHARACTERISTICS

(25° C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
LED					
Forward voltage (V_F)		1.3	1.5	V	I_F=40 mA
Reverse current (I_R)		1.5	10	μA	V_R=3.0 V
Capacitance			150	pF	V=0
Detector					
Forward blocking voltage (V_{AX})	200			V	R_{GK}=27 KΩ
Forward blocking current (I_{AX})		.6		μA	R_{GK}=27 KΩ, V_{CC}=50 V
Anode on voltage (V_{AK})		.9	.15	V	I_A=140 mA, V_{CC}=50 V
Holding current (I_H)		.1		mA	R_{GK}=27 KΩ
Coupled					
Turn on current (I_F)		6	14	mA	V_{CC}=50 V, R_{GK}=27 KΩ
t_{on} (t_r and t_d) (see note 2)		1.5		μs	R_{GK}=27 KΩ, V_{CC}=50 V
Resistance LED to SCR		10^{11}		Ω	$V_{E\text{-}D}$=500 V
Breakdown voltage LED to SCR	1500			V	
Capacitance LED to SCR		1.3		pF	

MCS2

ELECTRO-OPTICAL CHARACTERISTICS

(25°C Free Air Temperature Unless Otherwise Specified)

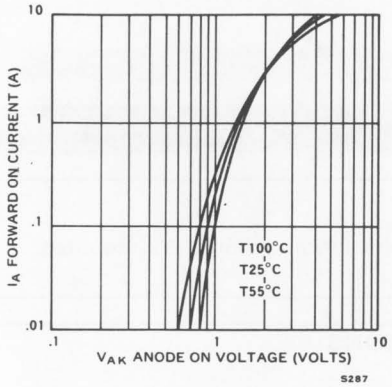


Figure 1

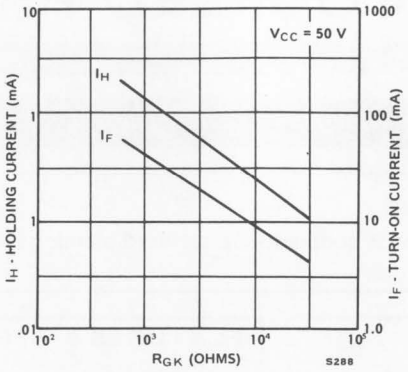


Figure 2

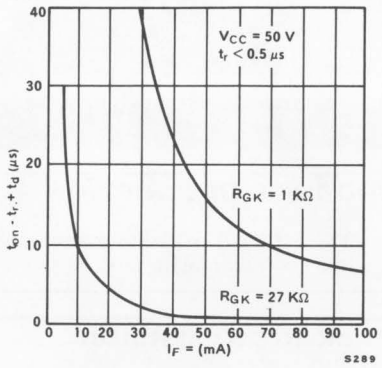


Figure 3

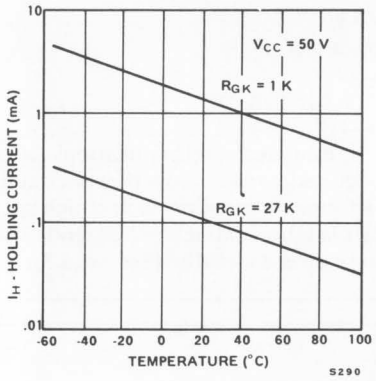


Figure 4

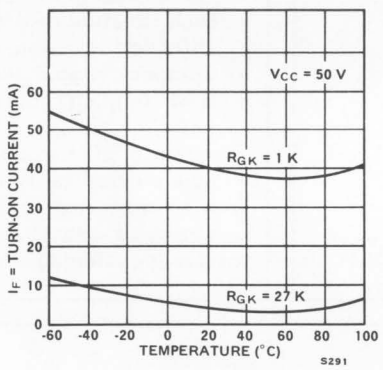


Figure 5

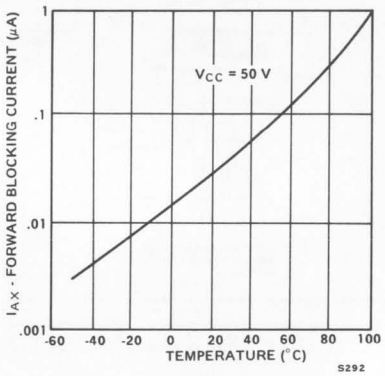
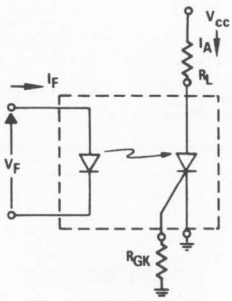
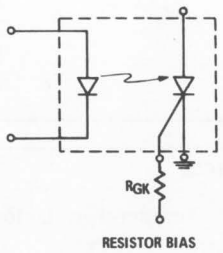


Figure 6

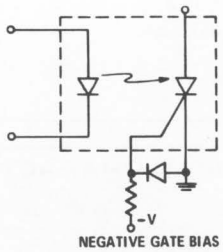
OPERATING SCHEMATICS



GATE BIAS CONSIDERATIONS



RESISTOR BIAS



NEGATIVE GATE BIAS

NOTES

1. *The maximum peak current depends on the duty cycle so as to stay within the average power of the device.*
2. *The rise time of the SCR is less than 500 nanoseconds.*
3. *For design information send for GaAs Lite Tip No. 4.*

Monsanto

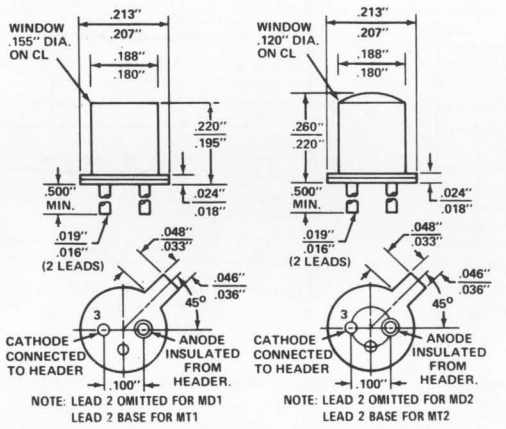
SILICON PIN PHOTODIODE

MDI MD2

PRODUCT DESCRIPTION

The MD1 and MD2 are diffused planar silicon PIN photodiodes. Both are mounted on a standard TO46 header. The MD1 has a flat window at the top of a metal shielding can. The MD2 has a domed lens in the window position for optical gain.

PACKAGE DIMENSIONS



NOTE: ACTIVE AREA=.0058 CM^2

FEATURES

- Fast Response 0.5 nsec
- Responsive To GaAs Sources 4.0 $\mu A/mW/cm^2$
- Responsive To Tungsten Sources 1.6 $\mu A/mW/cm^2$
- Optional Flat Lens or Built-in Optics
- Standard Transistor Package For Easy Handling and Mounting.

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These devices are recommended for applications in:

- high speed optical switching
- laser detecting
- optical encoding
- intrusion alarm or warning
- process control
- industrial control

ABSOLUTE MAXIMUM RATINGS

Maximum Storage and Operating Temperature	-55°C to 150°C
Maximum Lead Solder Time @ 260°C (See Note 1)	7.0 sec
Power Dissipation @ 25°C Ambient Temperature	300 mW
Derate Linearly From 25°C	2.4 mW/°C
Reverse Voltage	50 volts

ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Breakdown voltage	50			V	I_R=10 μA
Dark current (see note 2)		2.5	10	nA	V_R=20 V
Dark current at 100°C		200		nA	V_R=20 V
Capacitance		8		pF	V_R=20 V, f = 1.0 MHz
Sensitivity					
MD1 (see note 3)	.6	.8		$\mu A/mW/cm^2$	2875°K, V_R=20 V
MD2 (see note 3)	1.2	1.6		$\mu A/mW/cm^2$	2875°K, V_R=20 V
MD1 (see note 4)	1.5	2.0		$\mu A/mW/cm^2$	λ=.9 microns, V_R=20V
MD2 (see note 4)	3.0	4.0		$\mu A/mW/cm^2$	λ=.9 microns, V_R=20V
Rise time		0.5		ns	V_R=20 V, R_L=50 Ω

MDI MD2

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

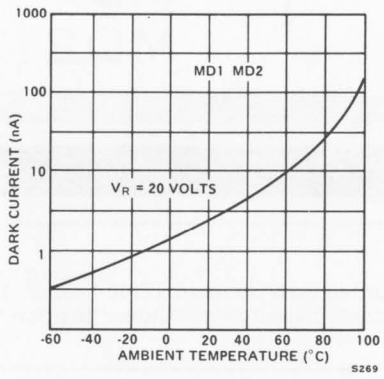


Figure 1 Dark Current vs. Temperature

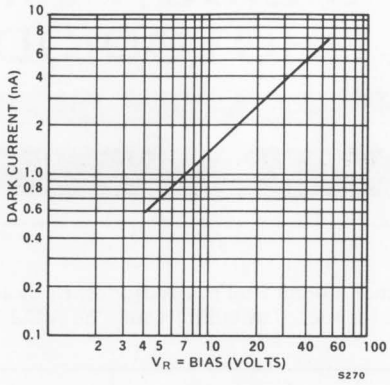


Figure 2 Dark Current vs. Bias Voltage

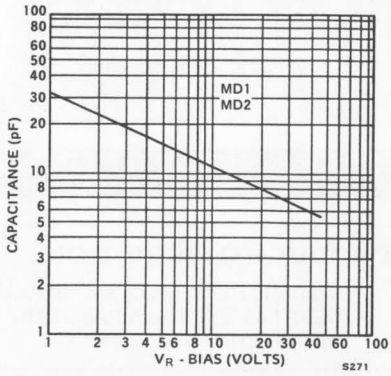


Figure 3 Capacitance vs. Bias Voltage

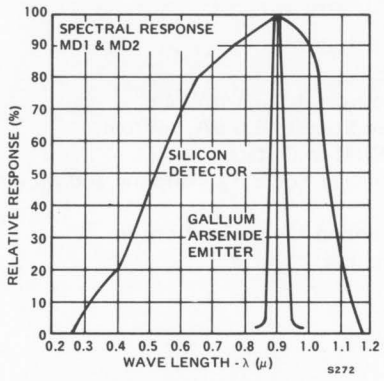


Figure 4 Spectral Response MD1 and MD2

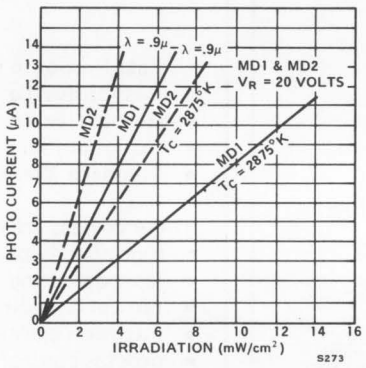


Figure 5 Photo Current vs. Irradiation MD1 and MD2

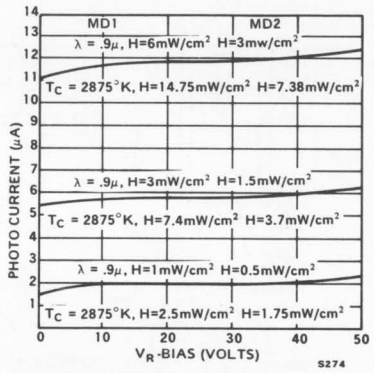


Figure 6 Photo Current vs. Bias Voltage

NOTE: *The axis of maximum sensitivity shall be within a 10° cone with reference to the central axis of the device.*

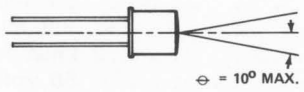


Figure 7 Angular Alignment

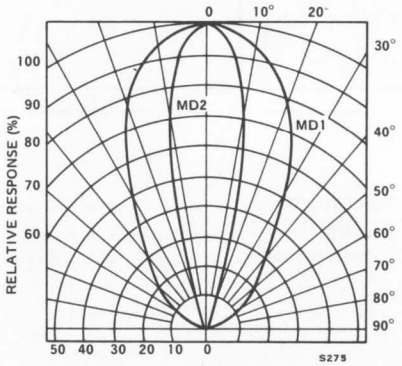


Figure 8 Angular Response

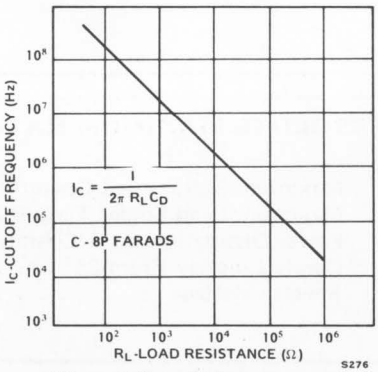


Figure 9 Cut-off Frequency vs. Load Resistance

(25°C Free Air Temperature Unless Otherwise Specified)

NOTES

1. *The leads of the device were immersed in molten solder, heated to a temperature of 260°C, to a point 1/16 inch from the body of the device per MIL-S-750.*
2. *Measured under dark conditions H≤1.0μW/cm².*
3. *Radiation flux intensity (H) of 5.0 mWatt/cm² as emitted from tungsten filament lamp operated at a color temperature of 2875°K.*
4. *Measured with a GaAs light source at .9 microns with a radiation flux density of 3 mWatt/cm².*
5. *Rise time - the time required for the current pulse to rise from 10% to 90% of its maximum amplitude.*

Monsanto

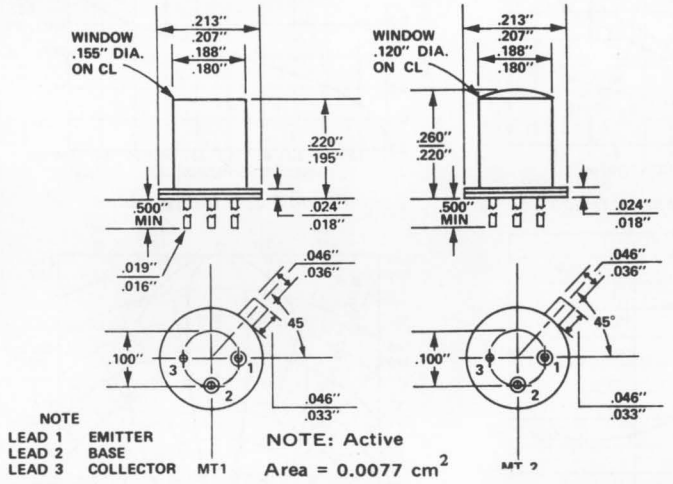
SILICON PHOTOTRANSISTOR

MT1 MT2

PRODUCT DESCRIPTION

The MT1 and MT2 silicon phototransistors are mounted on a standard TO header. The MT1 features a flat window mounted at the top of a protective metal can. The MT2 has a lens in the same position for optical gain.

PACKAGE DIMENSIONS



FEATURES & APPLICATIONS

- Low leakage current - 1 nA
- Wide Spectral Response
- Responsive to GaAs - 1.40 mA/mW/cm²
- Optional flat lens (MT1) or built-in optics (MT2)
- Standard Transistor (Hermetic Seal) package for easy handling and mounting

◆

- Optical switching & encoding
- Intrusion Alarm
- Process Control
- Tape and Card Reader
- Level & Industrial Control
- Optical Character Recognition

ABSOLUTE MAXIMUM RATINGS

Storage and Operating Temperature -55°C to 125°C
Maximum Lead Solder Time @ 260°C (See Note 1) - 7.0 sec

Power Dissipation @ 25°C Ambient	200 mW
Derate Linearly from 25°C	2.0 mW/°C
Collector-Emitter Breakdown Voltage (BV_{CEO})	30 V
Emitter-Collector Breakdown Voltage (BV_{ECO})	7.0 V
Collector-Base Breakdown Voltage (BV_{CBO})	80 V
Collector Current (I_C)	40 mA

ELECTRO-OPTICAL CHARACTERISTICS

(25° C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS & SYMBOLS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Sensitivity MT1 (see note 3) (S_{CEO})	200	560		μA/mW/cm²	λ=0.9 Ω, V_{CE}=5.0 V
Sensitivity MT2 (see note 3) (S_{CEO})	500	1400		μA/mW/cm²	λ=0.9 Ω, V_{CE}=5.0 V
Sensitivity MT1 (see note 4) (S_{CEO})	80	260		μA/mW/cm²	2875° K, V_{CE}=5.0 V
Sensitivity MT2 (see note 4) (S_{CEO})	200	650		μA/mW/cm²	2875° K, V_{CE}=5.0 V
Sensitivity MT1 (see note 3) (S_{CBO})	1.4	2.5		μA/mW/cm²	λ=0.9 Ω, V_{CB}=5.0 V
Sensitivity MT2 (see note 3) (S_{CBO})	3.5	6.2		μA/mW/cm²	λ=0.9 Ω, V_{CB}=5.0 V
Sensitivity MT1 (see note 4) (S_{CBO})	0.6	1.0		μA/mW/cm²	2875° K, V_{CB}=5.0 V
Sensitivity MT2 (see note 4) (S_{CBO})	1.5	2.5		μA/mW/cm²	2875° K, V_{CB}=5.0 V
Collector-emitter saturation voltage ($V_{CE(sat)}$)		0.2	0.5	V	I_C=2.0 mA, H=10mW/cm²
Light current rise time (see figure 8) (t_r)		2.0		μs	V_{CC}=5.0 V, I_C=2.0 mA, R_L=100Ω
Light current fall time (see figure 8) (t_r)		2.0		μs	V_{CC}=5.0 V, I_C=2.0 mA, R_L=100Ω
Delay time (see figure 8) (t_d)		1.2		μs	V_{CC}=5.0 V, I_C=2.0 mA, R_L=100Ω
Frequency response		300		kHz	V_{CC}=5.0 V, I_C=2.0 mA, R_L=100Ω

MTI MT2

ELECTRICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

CHARACTERISTICS	SYMBOLS	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Collector dark current (see note 2)	I_{CEO}		1	20	nA	V_{CE}=5.0 V
Collector dark current (see note 2)	I_{CBO}		0.15	10	nA	V_{CB}=5.0 V
Collector base breakdown voltage (see note 2)	BV_{CBO}	80			V	I_C=100 μA
Collector emitter breakdown voltage (see note 2)	BV_{CEO}	30			V	I_C=100 μA
Emitter collector breakdown voltage (see note 2)	BV_{ECO}	7	12		V	I_E=100 μA

TYPICAL ELECTRO-OPTICAL CHARACTERISTIC CURVES

(25°C Free Air Temperature Unless Otherwise Specified)

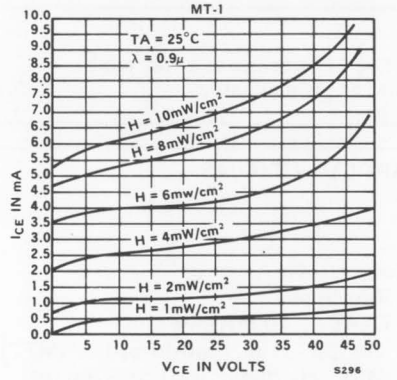


Figure 1 Collector-Emitter Characteristics

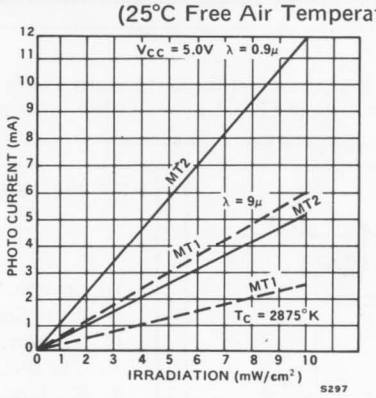


Figure 2 Photo Current vs. Irradiation

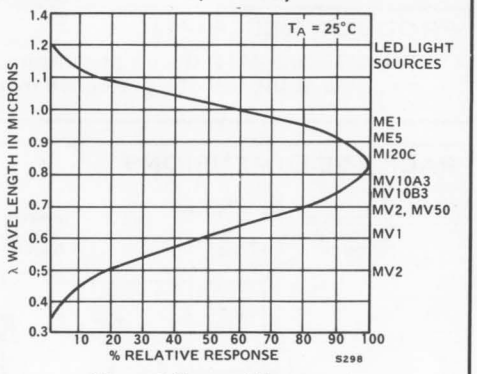


Figure 3 Spectral Response

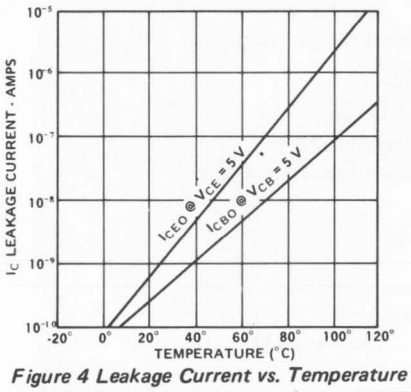


Figure 4 Leakage Current vs. Temperature

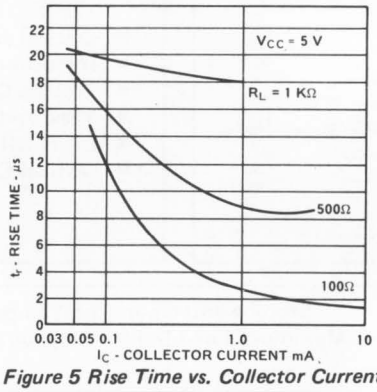


Figure 5 Rise Time vs. Collector Current

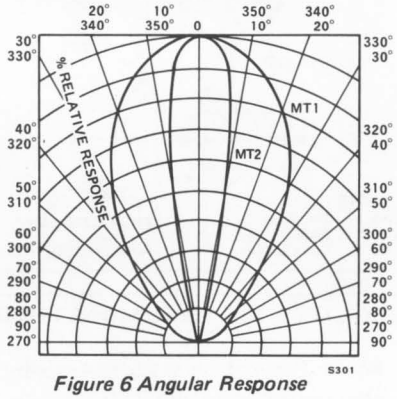
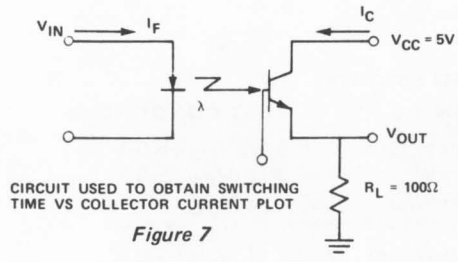
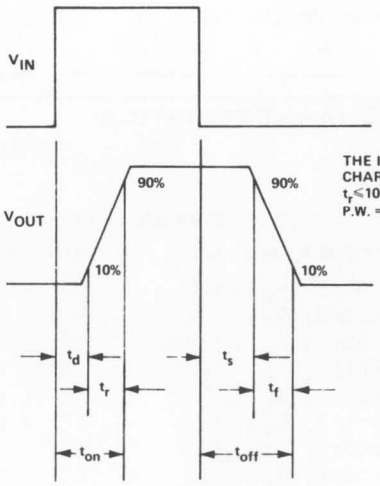


Figure 6 Angular Response



CIRCUIT USED TO OBTAIN SWITCHING TIME VS COLLECTOR CURRENT PLOT

Figure 7



THE INPUT WAVEFORM HAS THE FOLLOWING CHARACTERISTICS:
$t_r \leq 10ns$, $t_f \leq 10ns$
P.W. = 50μs, f = 100Hz

Figure 8

NOTES

1. *The leads of the device were immersed in molten solder, heated to a temperature of 260°C, to a point 1/16-inch from the body of the device per MIL-S-750.*
2. *Measured under dark conditions $H \leq 1.0 \mu W/cm^2$.*
3. *Measured with a GaAs light source at 0.9 microns with a radiation flux density of 3 mW/cm^2.*
4. *Measured with a tungsten filament lamp operated at a color temperature of 2875°K with a radiation flux density of 5 mW/cm^2.*

Monsanto

CO2 LASER MODULATOR

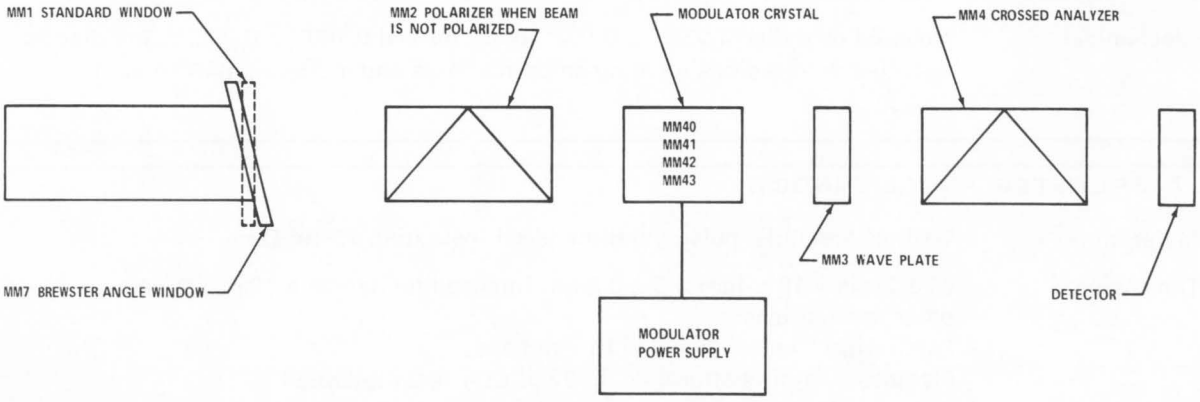
MM1 MM4 MM2 MM7 MM3

FEATURES

The MM series is a new line of components using GaAs and CdS material specially developed for use with CO_2 laser communication systems. The MM1 window is useful for all CO_2 laser applications.

- Single crystal material giving constant absorption coefficient over a wide range of power density
- Low absorption - 1.2%/cm typically
- Thermally stable to 800°K. No room temperature thermal runaway. No thermal distortion.
- Not attacked by humidity
- No plastic deformation
- Ground to excellent optical finish
- Resistant to thermal fracture
- High power handling capability
- Physically durable
- No crosshatched distortion

SCHEMATIC OF LASER MODULATOR SYSTEM



MM1 MM2 MM3 MM4 MM7

MM 1 10.6 MICRON WINDOW

Material:	Gallium Arsenide, single crystal, semiinsulating, $\rho > 10^8 \Omega$cm.
Dimensions:	Diameter: 26.3 ± 0.2 mm, Thickness: 2.8 ± 0.3 mm Parallelism: better than 10^{-3} radians. Flatness: better than 0.1 λ of CO_2 laser radiation over a diameter of 24mm.
Finish:	Both sides polished to 10-1 surface quality. Both sides antireflection coated with maximum reflectivity of 5% per side at 10.6μ.
Optical Absorption:	Less than 0.5% (total).

MM 2/ MM 4 POLARIZER-ANALYZER FOR 10.6 MICRON LASER RADIATION

Active Element:	Gallium Arsenide, semiinsulating, single crystal, $\rho > 10^8$ Ω cm. Two plates set at opposing Brewster angles so that there is no net translation of the beam path.
Optical Characteristics:	Aperture: 0.5 cm, Absorption: <1%. (Total) Polarization purity of output beam > 0.98 Maximum power handling: 20 watts rejection.*
Mount External Dimensions:	Cylinder 1.250'' ± 0.002'' diameter × 2.490'' ± 0.005'' long. Indices are provided locating accurately the plane of polarization and a direction 90° from it.

*EXAMPLE: The polarizer can handle 40 watts of randomly polarized input, 20 watts of polarization crossed to the polarizer, and more than 200 watts of input polarized parallel to the polarizer. In the latter case, power is limited by absorption losses.

MM 3 WAVEPLATE FOR 10.6 MICRON WAVELENGTH

Active Element:	Cadmium Sulfide
Optical Characteristics:	
Phase Shift:	At 10.6μ wavelength the element produces net 90° phase shift in time between light traversing it with polarization along its fast and slow axes.
Operating Wavelength:	10.6μ
Aperture:	0.5 cm.
Absorption:	<5% (Total)
Mechanical:	Mounted on a disc 1.250'' ± 0.002'' diameter and 0.160'' ± 0.005''. The disc is supplied with indices locating an optical axis and a direction 45° from it.

MM 7 BREWSTER ANGLE WINDOW

Material:	Gallium Arsenide, polycrystalline/semi-insulating $\rho > 10^8 \Omega$cm.
Dimensions:	64 ± 2 mm × 18 ± 1mm × 3 ± 0.2mm. Intended for use on a 12mm ID tube, and other applications. Parallelism: better than 2×10^{-3} radians. Flatness: within better than 0.15 λ of CO_2 laser radiation. Both parallelism and flatness limits are over the central 58 x $12mm^2$.
Finish:	Both sides polished to 30-20 surface quality.
Optical Absorption:	Probably less than 1% (accurate absorption measurements on polycrystalline material are not available).

Monsanto MODULATOR CRYSTAL | MM40 MM41 MM42 MM43

PRODUCT DESCRIPTION

The MM series of electro-optic modulator crystals operate at a wavelength of 10.6 microns, which corresponds to the frequency emitted by CO_2 lasers.

These modulators are all rectangular parallelepipeds of single-crystal, semi-insulating gallium arsenide (See figure 1 and table 1).

The two ends (110) are parallel to better than 0.003 mm and polished flat to within one wavelength of sodium light. An anti-reflection coating on these flat surfaces yields a maximum reflectance of 10% per face (typically, 5% per face) at a wavelength of 10.6 microns.

The two (110) faces have a low resistivity coating for connecting pressure contacts.

THEORY OF OPERATION

GaAs becomes bi-refringent when an electric field is applied along appropriate crystallographic directions. This means that linearily polarized light will become elliptically polarized after passing through a biased crystal. This characteristic, combined with the correct arrangement of polarizers and wave plates, allows the modulator crystals to modulate either amplitude, phase, or polarization.

TABLE OF MODULATOR DIMENSIONS

Modulator Dimensions (millimeters) ±5%

TYPE	LENGTH (110)	WIDTH (001)	DEPTH (110)
MM40	50	3	3
MM41	50	5	5
MM42	50	7	7
MM43	50	10	10

ELECTRO-OPTICAL CHARACTERISTICS (25°C Free Air Temperature Unless Otherwise Specified)

Resistivity . . . . . minimum 10^7 ohms-cm
Breakdown field . . . . . minimum 7000 volt/cm
Absorption coefficient @10.6μ . . . . . maximum 0.02 cm^{-1}
Electro-optic coefficient @10.6μ . . . . . .typically 1.3×10^{-10} cm/volt
Extinction coefficient of crystal between crossed polarizers @10.6μ . . . . . .minimum 0.99
Capacitance . . . . . typically 6 picofarads

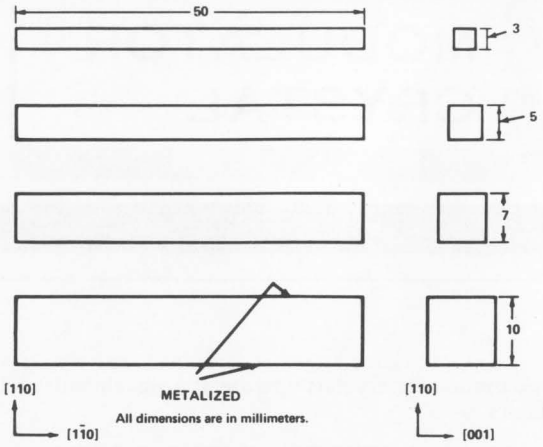


Figure 1 MM Series Outline Drawings

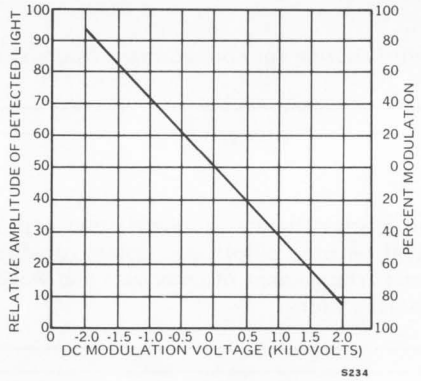


Figure 2 Typical Performance Characteristic of MM40 Crystal Used as an Amplitude Modulator[1]

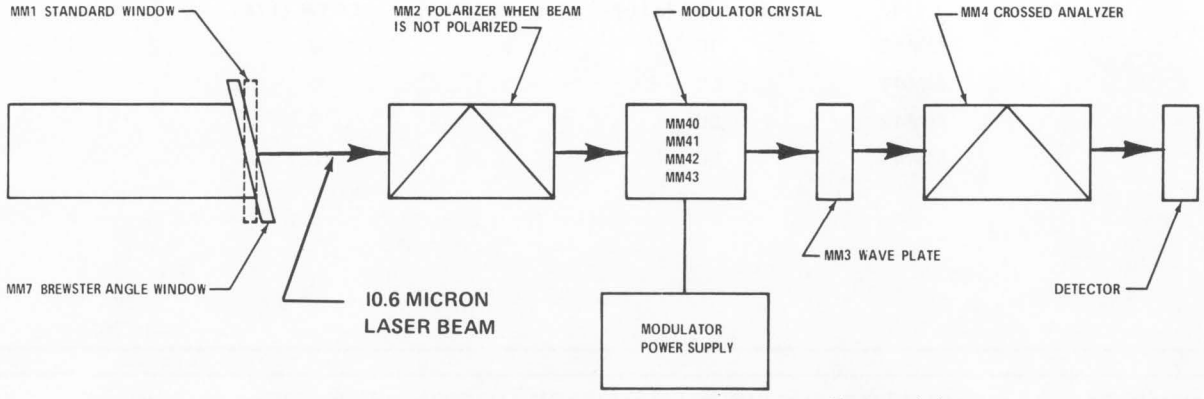


Figure 3 Optical Path Used to Obtain Typical Performance Characteristics

NOTES

1. *The sign of this slope may be reversed if the other face of the crystal is presented to the beam; that is, if the crystal is rotated 180° around [110]. The curve is non-linear above 2000 volts. The characteristics shown are for the MM40; characteristics for the other modulators are similar, and they all modulate the same amount for the same amount of field strength (kV/cm).*

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